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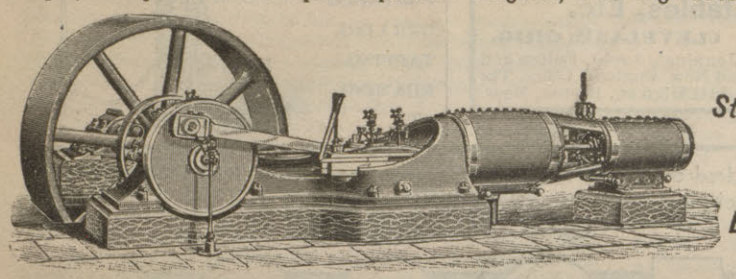

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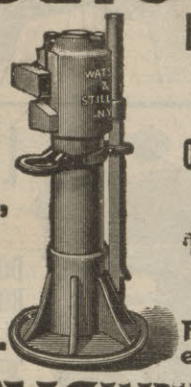

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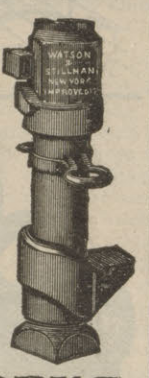

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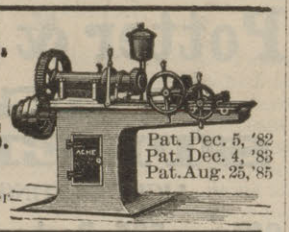

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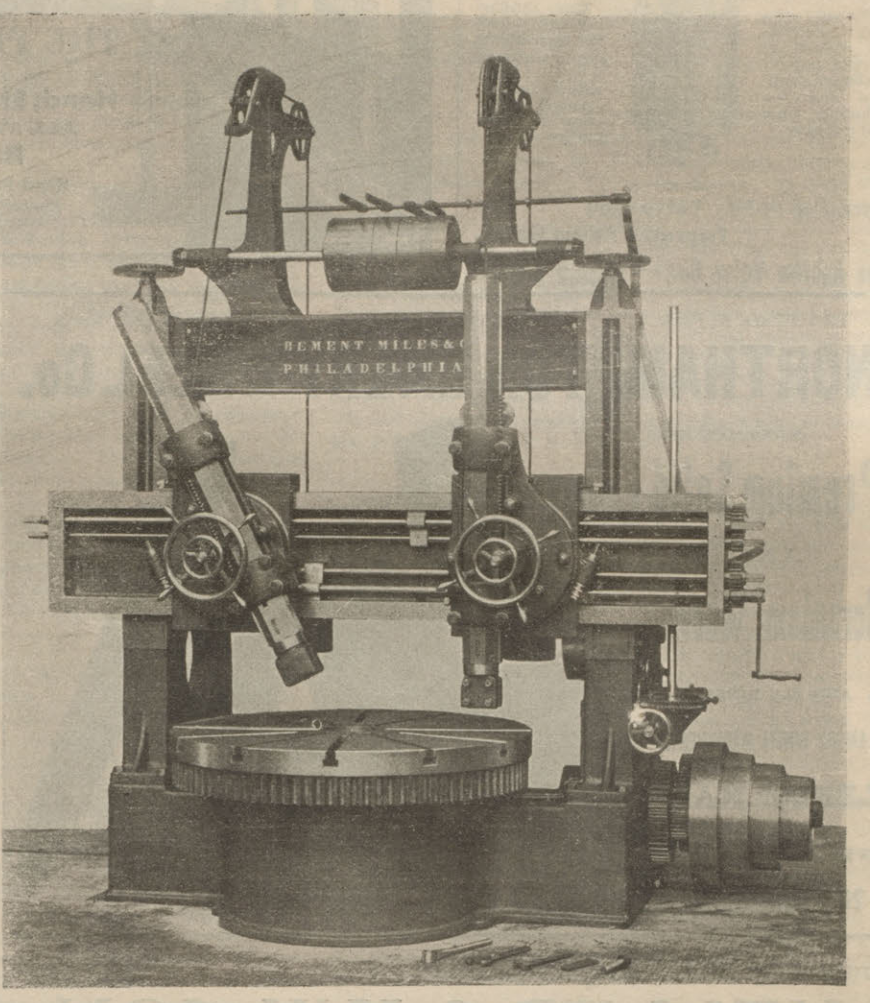

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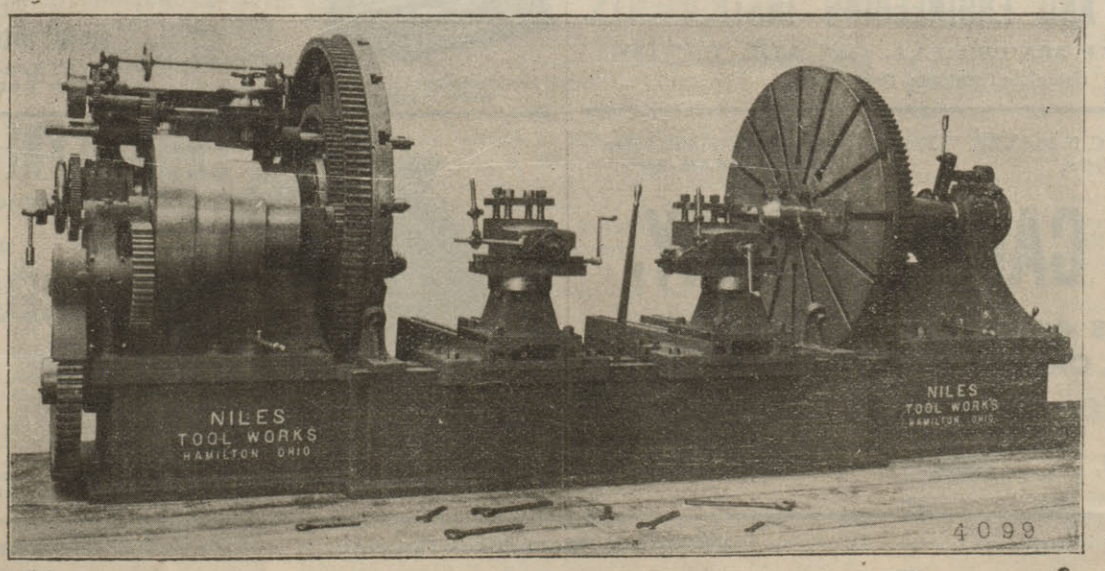

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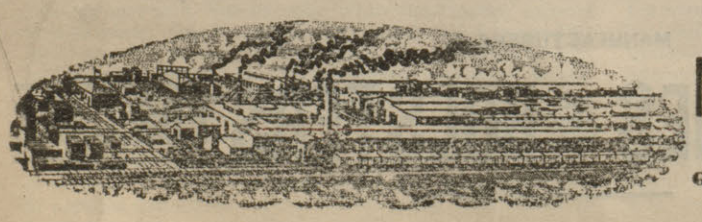

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THE RAILWAY REVIEW

XXXVI. MARCH 21, 1896. No. 12.

Uses of Air in Railroad Shops.—In the Union Pacifi, shops at Omaha compressed air is used for sandpapering the sides of cars. A sandpapering disc is caused to rotate at about 2,500 revolutions per minute. The New York Central & Hudson River Railroad uses compressed air in its West Albany shops on all benches for cleaning injectorse checks,cocks and all classes of work that require cleaning. The Southern Railway Company use compressed air for such work as sandblasting, loading and unloading heavy supplies, such as car wheels, etc., raising and lowering cabs, and many other purposes. Mr. J. H. McConnell, of the Union Pacific system, says: "We are constantly finding more uses for compressed air, and at the present time we find that it would be an impossibility to get along with our work without its use."

Our Forests.—The total forest area in the United States is estimated at about 495,000,000 acres, or 26 per cent of total area, of which about 40 per cent is in farms, while the area of land in farms unimproved or waste not in forest may be estimated at about 75,000,000 acres. Alaska and the Indian reservations are not included. The present annual requirements for consumption of forest products in the United States are approximately over 24,000,000,000 cubic feet made up of the following items: Lumber market and manufacture, 5,000,000,000 cubic feet; railroad construction, 600,000,000 cubic feet; charcoal, 250,000,000 cubic feet; fences, 500,000,000 cubic feet; fuel, 18,000,000,000 cubic feet; mining timber, 150,000,000 cubic feet. At the present rate of cutting the remainder of forests in the United States cannot long meet the enormous demands on its resources. Of the two most important timbers for building purposes, the merchantable white pine of the Northwest and of New England is practically gone, very little remaining, and there remains of the merchantable long leaf pine of the south only about 1,500,000,000 cubic feet. The valuable ash will probably be the first to be exhausted. Walnut and tulip trees are are also on the wane. Forest fires are estimated to destroy values of about $12,000,000 annually, but during the year 1894 that amount appears to have lost in Minnesota and Wisconsin alone.

Chemical Analysis of Iron and Steel.—The belief is quite common, especially among those who have had little or no experience in the practical work of steel manufacture, that a thorough chemical analysis will indicate precisely the character and quality of steel; yet those who are more familiar with such matters have long been aware that this is not at all the case, and it is a fact, says the Ameril can Machinist, that two different brands of steel which will appear to be precisely identical, so far as the most rigid chemical analysis can show, will be totally different when put into service, and will give different results under physical test. Nearly, if not quite, all the prominent steel makers of this country have made steel springs to the specifications of the Pennsylvania Railroad. These specifications require that the steel shall show a certain chemical analysis; and yet it is a fact that one certain maker who makes steel which conforms to the requirements precisely so far as chemical test can determine, yet not more closely than the other makers conform to it,gets in the open market a considerably higher price for his springs than any other maker. And the railroad company in question has demonstrated to its satisfaction that it can afford to pay this higher price because the springs, notwithstanding that chemical analysis shows them to be precisely identical with the others, give enough better results in service to more than justify the higher price. It is the same with fine irons. Take Swedish iron as an example. It is welknown that this iron possesses certain qualities not possessed by any other known iron, and finer steel can be made from it than can be made of any other iron known; yet irons have been produced in the United States,which so far as the most exhaustive chemical tests can show are precisely identical with this Swedish iron. In short, it seems to be clearly demonstrable that a chemical test will not tell us all we must know about such matters. But recently the microscope has been applied to this work, and it has been found that where chemical analysis fails to show the difference between two specimens of steel or iron, the microscope will show a very decided difference between them, and the difference thus shown seems to bear some relation, more or less exact, to the differences that are shown by the same specimens under physical tests.

Accidents on Indian Railways.—It would scarcely be imagined, says an English journal, that the Indian railways would enjoy such marked immunity from accident as appears to be the fact, for it must be conceded that only one passenger killed by accidents to trains out of more than thirty-four millions carried in the course of three months, is an achievement which will not be readily beaten—even by the record-breaking Yankees. The last quarter's return of the working of the Indian railways shows that seventeen and a quarter millions of train miles were covered during that period. The proportion of passengers injured by accidents to trains was one to little less than seven millions. The total mortality, including suicides, accidents at level crossings, and deaths resulting from personal carelessness, and including accidents to railway servants, was 160 only, while the number injured was 30 more. One passenger was killed and 5 injured by accidents to trains, rolling stock or permanent way, and 20 killed and 38 injured by accidents from other causes, including those arising from their own want of caution or misconduct. Forty-one railway servants were killed and 121 injured by accidents from all causes; 3 persons were killed and 4 injured while passing over railways at level crossings; 71 trespassers were killed and 20 injured; and 23 persons committed suicide by throwing themselves in front of trains.

The Siberian Railway.—From Tscheljabinsk a distance of about 1,280 miles is now being used for traffic, and the favorable effect of the railway upon industry and commerce is already perceptible. The towns along the line increase in size and number of inhabitants, and the imports already comprise articles which were previously unknown. In the principal streets of Tomsk electric light has been, or is just about to be adopted, and the journey from Moscow to Tomsk can now be compassed in eight days. The railway department has hired a large number of workmen in Finland, who will be employed at the works on the Siberian Railway.

Illuminating Gas from Wood.—The town of Deseronto in Canada, where there are several large lumber mills, is partially lighted by gas made from sawdust. The Engineering and Mining Journal states that the sawdust is charged in retorts, which are heated by a wood fire, the gas from the retorts passing into a series of coils and thence into the purifiers, which are similar to those used for coal gas. Lime is the principal purifying agent employed. When it passes out of the retorts the gas possesses an odor much less disagreeable than that of ordinary lighting gas, and resembles somewhat that of the smoke from a fire of green wood or leaves. The works in use are small, turning out daily 540 cubic meters of gas, for the production of which about two tons of sawdust are required. A man and boy furnish all the labor needed at the works. The gas in an ordinary burner gives an illumination of about 18 candle power. The best quality comes from resinous woods. A quantity of 100 kilogs. of sawdust leaves a residue of 20 kilogs. of charcoal.

Waterproofing Brick and Sandstone.—According to the Mining and Scientific Press, a number of experiments have been recently made to ascertain the length of time that brick and sandstone are rendered waterproof or protected by oil. The three oils used were linseed oil, boiled linseed and crude mineral oil. The amount of oil and water taken up by the sandstone was very much less than that absorbed by the brick, although the area of the sandstone cube was much greater. Equal amounts of the raw and boiled oil were absorbed. The mineral oils, however, were taken up in much greater quantities by both brick and sandstone. By the end of 12 months the mineral oil evaporated from the bricks, but such was not the case when the other oils were used. After an exposure of four weeks the bricks practically retained all their oil, inasmuch as they had not lost any of their weight and were also nearly impervious to moisture. It was noticeable that the sandstone cubes treated with linseed oil returned to their original weights, but do not appear to have lost the beneficial effect of the oils, being also practically waterproof.

The Tyranny of Trades Unions.—A striking example of the manner in which the trades unions interfere with the action of workmen and so add to the expense and cripple the operations of trade, is afforded by a strike that was in force a short time ago at Liverpool. The men employed in loading two steamers were stopped by the union delegates on the ground that, whereas, according to union rules, only four bags of goods could be placed in the slings; they were putting in five bales. Now, as the cranes by which these steamers were being loaded were worked by steam, there was no question of men being called upon to labor beyond their strength. The rule would therefore appear to be simply a device to prolong by one-fourth the operation of loading, thus adding 25 per cent. to the labor cost. It is, in fact, neither more nor less than a tax upon employers of five shillings in the pound, for the benefit of the members of the union. To the general public, ignorant of the manner in which most of the unions restrain members from working up to anything like their real power, it would seem incredible that such a restriction should be imposed in regard to steam cranes. The same principle, however, handicaps employers in almost every branch of trade. Colliers are forbidden to fill more than a certain number of corves a day; bricklayers may not lay beyond a prescribed number of bricks, less than half that which a good workman would lay. So it is in other branches of labor; but it must be acknowledged that the attempt of the laborers in the Liverpool docks to restrict even steam power quite out-Herods Herod, and is, perhaps, the most outrageous attempt yet made to augment the cost of labor.—[Cassier's Magazine.

A Southern Invention.—N. H. Smith, foreman of the Norfolk & Western at Bristol, Tenn., is reported to have patented a device for making fires in locomotives that is attracting much attention. It is a small machine on wheels and is run on the ground. It is stopped near an engine and a small hose attached and run into the fire-box. A shovelful of coal is thrown in on the grates and then a little ball of waste is lighted and laid on the coal. The hose is turned on and at once the fire-box is filied with a soft white blaze. The machine causes a spray of oil and air to go out at once which completely fills the fire-box. The coal is soon ignited and a heap of red hot coals, the hose is taken out and more coal added and the fire is made. It is stated that one gallon of crude petroleum will make four or five fires by this process at a cost of about one cent for each fire. No kindling wood whatever is needed.

Uses for Railroad Scrap.—For the purpose of utilizing what would otherwise be waste material and worthless, the Southern Pacific Railway Company has consructed at Sacramento a small rolling mill with a single train of 12-inch rolls. Scrap material which has been in use for some time, subject to heavy strains and severe shocks, is cut into short lengths and stacked into two hundred pound piles, and it is then placed in a blooming furnace, and after reaching the proper temperature is forged under a steam hammer into billets or slabs, these being then cut up, repiled, and subjected to the same treatment as before. They are forged to the proper dimensions for use in the locomotive, car, or track department. Some of the billets are rolled in the mill into shapes for bar iron, fish plates, spikes, bolts, nuts, and similar objects, the annual output being from 10,000 to 12,000 tons, at a cost of about half a cent a pound. All good iron received with the scrap is cut into such lengths as are useful in car repairs and similar work, but all iron that has been bent to a sharp angle is worked over again; old car axles are rolled into bars 6 in. wide and three-fourths thick, and are cut up in lengths of 42 in. these bars being then worked over into new angles.

Trading in Futures in 1636.—That buying for future delivery is not a modern invention is evidenced by the following letter written by Samuel Symonds, deputy governor of Massachusetts, living in Boston, to John Winthrop, Jr., governor of Connecticut, home in Ipswich, Conn., next to Thomas Boardman: "I desire you would talk with Mr. Boardman and with his help buy for me a matter of 40 bushels of good Indiana corne of him or of some honest man, to be paidd for now in ready money and to be delivered at any tyme in sumer as I please to use it. I would deale with such a man as will not repent if corne rise, as I will not if it fall." This letter was written in 1636, and appears in the "Boardman Genealogy" just published. The essential difference between present methods and those then employed is that then the buyer wanted the actual corn; now he does not.

Another Self-Contained Electric Locomotive.—The Engineering News referring to a new electric locomotive which has been designed in this country, somewhat on the idea of the Heilmann locomotive illustrated in our columns last year, pertinently observes that it is sorry that the French are not to have a monopoly of this idea. The plan of combining in a single machine a boiler, engine, dynamo, storage battery and electric motor with the numerous operating and controling devices which each require, and all for the purpose of propeling a car along a railway track, is one which harmonizes much better with the French mechanic's penchant for complication than the American practice of choosing the simplest and most direct means of reaching a desired end. Lest the above note should be misunderstood, we will add that we know of no reason why Mr. Walkin's locomotive, if it is actually built, should not run, and perhaps run as fast and haul as heavy a train, or perhaps heavier. in proportion to its weight than a steam locomotive; it may even be found possible to so manipulate figures as to make an apparent saving by its use. That remarkable feat was performed by the promotors of the Heilmann locomotive, and could, we doubt not, be equally well done here. But no matter how fast the locomotive may run or how skillfully its promotors may present their estimates, the fact will remain that it is a mechanical absurdity to develop mechanical power on a locomotive and then proceed first to convert it into electric current and next to convert that current back into mechanical power in order to apply it to the driving wheels.

Spring Track Work

With the coming of spring again the trackmen find themselves face to face with more work than usual. During the past two years the railroads have generally reduced their expenses to such an extent that their roadbed has been allowed to deteriorate considerably. The cuts and fills are neglected, track run down and ties rotten,and as this has gone about as far as the limit of safety will permit, the lines of the west will be compelled to spend considerable money on repairs this year, whether their earnings justify it or not. The rotten ties are perhaps of more concern to the foreman than rough track, for while the latter may cause some uneasiness, if he puts in his time judiciously he can prevent it becoming dangerous,but if his section has many rotten ties he can never feel certain that trains will get over it safely.

If times are hard, a railroad manager may practice economy in many ways. Clerks are cut down, trains and train crews laid off, laborers and shopmen reduced and wages lowered, but the rotting of the ties goes on just the same as if everything was having a boom. This is a process that is not subject to the fluctuations of the money markets and continues constant under all circumstances. However, trackmen may expect that their wants will receive more attention this year than during the past two, and each section is likely to receive a considerable number of new ties. This will probably soon revive the discussion as to the number of ties a man can put in the track in a day. But the conditions are so diverse and the quality of work done varies so greatly that the mere statement that so many ties were put in means almost nothing.

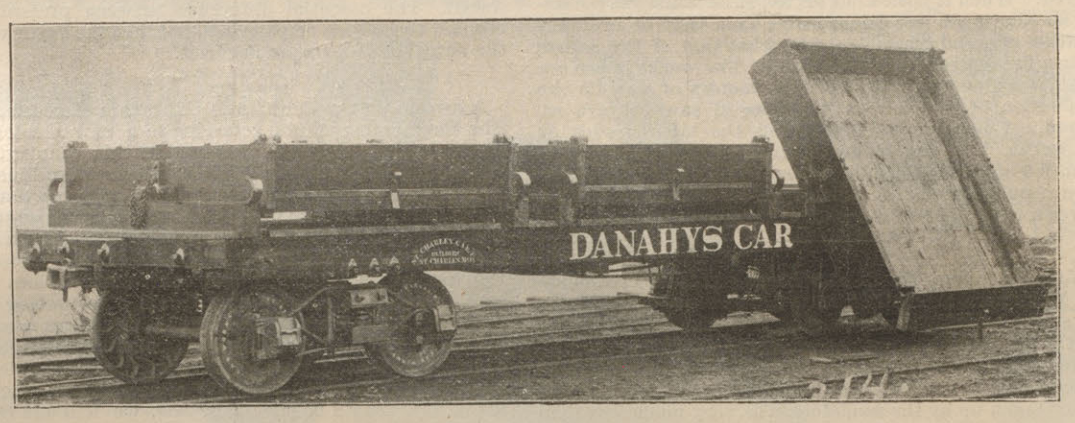
The writer has often noticed that the average section foreman in the hurry of spring work does not pay as much attention to putting in ties at joints as he should. It is a very common thing to see a medium or small tie under the joint and a large one adjoining it. This is wrong, of course, because the weakest point should have the greatest support. If one would avoid surface bent rail ends, never put a large tie within six feet of the joint. In this space nothing should be used except medium or small ties. Experience proves that low, short quarters are very scarce on American roads, so no trouble may be apprehended on this score; for, generally speaking, too many ties per rail are used on our lines. Foreign railroads usually space ties two feet, center to center, and maintain good track too. Another oversight on the part of the average foreman when raising track or putting in ties consists of leaving an old tie under a joint and putting a new tie in next to it, simply because the old one will last a year or two longer. If the old tie is moved to one side and a new one in its place the old tie will last longer under the shoulder than it would under the joint, and when it does become necessary to take it out the solid bed under the joint tie would not have to be torn up. By following this method joints will always have large ties under them.

A carload of ties consists of about 150 or enough for eight rails, and among this number one can certainly find eight wide, sound joint ties if he will look for them, and the resulting good track will more than compensate for any extra care required to have the work done in other than a haj-hazard way. In fact, the greatest measure o success comes to those foremen who give the joints the most attention.—[Jerry Sullivan in Roadmaster and Foreman.

THE DANAHY DUMP CAR.

The accompanying illustration shows the general appearance of a dump car which has been manufactured in considerable numbers by the St. Charles Car Company of St. Charles, Mo. It consists of an ordinary flat car with three square boxes or hoppers resting thereon. These hoppers are each 7 ft. 6 in. by 8 ft. 6 in. by 14 in. deep and will hold 3¾ cubic yards each. They rest on rollers secured to the floor of the car and have a trunion on each end. For unloading, the hopper is pushed to the side of the car when the trunions catch in bearings provided for the purpose and as the hopper swings down over the side of the car the load slides out after which the hopper is returned to its normal position and is ready for reloading.

The greatest advantages claimed for the car are its extreme simplicity and the fact that it can be dumped on either side. A supply of these hoppers can be kept on hand and applied temporarily to ordinary flat cars when a large job of hauling earth or ballast is on hand.



DANHY'S DUMP CAR.

THE RAILROAD FROM TIEN-TSIN TO SHAN-HAI-KUAN.

About 17 years ago, there was in the whole Empire of China one short iron tramway 10 miles in length. This tramway ran from the Kaiping coal mines, which mines are 80 miles from Tien-Tsin to the sea. How long it had been built at that time, I do not know. The motive power of this railroad was man. The small cars were loaded with coal, and pushed down to the sea, unloaded, and pushed back again. This work was done by coolies, who worked 12 and 14 hours daily, and were paid 10 cents (Mexican) a day.

At this time the works were put in charge of a young English engineer, who, restless, enthusiastic, and modern, knew nothing of Chinese lethargy or the conservatism of their institutions. He ventured to propose many changes to facilitate the work and decrease the expenses. He was ignorant of Chinese superstitions of *feng shui*, and that his desired changes would, in the eyes of the Chinese, displease the spirits of air and water with the result of ruined crops and disastrous climatic disturbances. The authorities at Peking promptly vetoed attemps at progressive measures.

Despite the Peking government, there was one thing he would have, and that was a locomotive, and to have a locomotive was to build it himself. His workshop was a mat shed, and the tools at his command were few. Four small driving wheels were ordered from the United States, an old disabled stationary engine furnished the boiler, and a broken down winding engine the cylinders.

The "Rocket" as this engine was named, was a startling object to the Chinese as it flew over the track, with large yellow dragons emblazoned on its sides. Thus was made, owing to the determination and ingenuity of a young engineer as yet unimbued with oriental ideas, the first locomotive in China.

In due course, the Peking government heard of the innovation. Consternation reigned, and the Rocket dragon was ordered to be summarily suppressed. The Chinese director of the mines, however, permitted its use for short trips inside the yard, and gradually the length of its travels was extended. It was found that war, pestilence, and famine did not follow, and that the *fang shui* of the locality was undisturbed by the iron steed. Imperial permission was at last granted for its free use.

This was the beginning of railroads in China, and the man who, 17 years ago constructed the Chinese "Rocket," is to-day the chief engineer and general manager of the imperial Chinese railroads. His name, familiar to all railroad men in America, is C. W. Kinder.

The line as at present finished, begins at Tien-Tsin. The first important shop is at Tongku, 27 miles from Tien-Tsin and 6 miles from the mouth of the Pei-ho, at the Gulf of Pechihli. Both Tien-Tsin and Tongku are on the Pei-ho by which waterway steamers reach Tien-Tsin. From Tongku, the road swings off to the northeast to Shan-Hai-Kuan—the terminus of the present operated line and the terminus on the Gulf of Pechihli of the Great Wall. Shan-Hai-Kuan is distant from Tongku about 150 miles. Surveys have been made for 200 miles beyond the gap in the Great Wall at Shan-Hai-Kuan, and construction has been completed for a distance of 10 miles.

The line, when finished, will run to Kirin, the center of Manchuria. A branch will also be built to the head of the Gulf of Liao-tung, where there is a good harbor. During the recent war with Japan, work on the road was interrupted and has not yet been resumed.

A trip over this line to Shan-Hai-Kuan presents many points of interest. All the foreigners employed are either English or Scotch; English methods, therefore, largely prevail. The greater part of the line runs through a flat alluvial country, which, during the rainy season, is subject to heavy floods. The location of the line presents no engineering difficulties. The sharpest curve has a radius of 1,000 ft. There is only one of these curves, and it was made necessary, not by the contour of the country, but by the location of two private cemeteries that could not be molested. The majority of the curves have a radius of not less than 3,000 ft. The maximum grade is three-fourths of 1 per ceut.

The country from Tien-Tsin to Shan-Hai-Kuan contains no large towns or cities, but a great number of mud villages. As yet, it is strictly an agricultural country. The staple product is corn, insufficiently produced to support the natives. The Kaiping coal mines, about 80 miles from Tien-Tsin on the road, comprise the only mining industry as yet in operation, although there are deposits of coal, iron, gold and silver awaiting the intelligent application of capital.

The natives are very poor, and it is only by putting the railroad rates down to a mere trifle that they can be induced to travel. To give an idea of the condition of the people, I would state that at and around Tong-shan, the center of the operated line, and the location of the Kaiping coal mines, it has been estimated that about 50,000 natives died of starvation during the months of March and April of this year.

The trains are all "mixed"—freight and passenger. From Tien-Tsin to Tongku, there are four trains each way daily, and from Tongku to Shan-Hai-Kuan, there is one train each way daily. The trains are not all heavy and, in speed, average 15 miles per hour. The road usually pays its running expenses, but as yet has yielded no interest on the first cost of construction and equipment. I have been unable to ascertain the cost of construction.

The building of the road, with its entire equipment, has been done with the English idea of permanency, and without regard to first cost, or the work required of it. No wooden structures are seen from one end of the line to the other. Stone, brick, concrete or steel are the materials used. The road is a standard gage, and its bed is somewhat wider than in our country. On the subgrade, there are 12 or 15 in. of stone ballast, all of which is broken by hand. The company has at Shan-Hai-Kuan, one small Blake crusher with which it is experimenting, but owing to the cheapness of coolie labor it is doubtful if steam crushers will pay. The rails used are steel, 60 lbs. to the yard, Sandberg pattern. They were made at Barrow, England, or by Blockow & Vaughn, and were delivered at Takee for less than $21 per ton—or at a price that can not be touched by any of our firms. The only profit received by the English firms was due to a fortunate rate of exchange at the time of delivery. The wooden ties are 8 ft. long by 6 by 9 in. They are spaced 28 in. center to center. Most of them come from Japan, some from Oregon, and a few from Vladivostock. They cost, laid, about 72 cents (Mexican) each.

Owing to the immense rainfall and to the limited time in which it falls, unusually large flood openings are necessary. In going over the line during the dry season, one looks with surprise at these openings in the grading, but in some cases they are not yet sufficiently large. Last year, 14 in. of rain fell in six hours at Shan-Hai-Kuan. During the rainy season of four months, the total rainfall is usually about 140 in.

The soil is alluvial deposit, and varies in depth from 20 to 60 ft. The masonry on the line is all first-class cut stone, laid in English portland cement. The cost of this cement here is about 75 cents per barrel less than in the United States. The foundations for the piers, abutments, etc., are carried down to solid rock. The deeper foundations are laid by means of wrought iron caissons, sunk by the pneumatic process, and then filled with portland-cement concrete. This system of foundations works well here, and the natives take kindly to it as "sinkers." The lengths of the spans used vary from 20 to 200 ft. The majority, however, are short and are deck girders. The head room, under the girders, is from 7 to 16 ft.

LAN-HO BRIDGE.

All of the bridge work is riveted, with the exception of the Lan-Ho bridge, which is looked upon here as an engineering wonder. This bridge consists of two roadway spans of 30 ft. each—ten spans of 100 ft. each and five spans of 200 ft. each. The total distance between the face of the abutments is 2,170 ft. The 200 ft. spans are pin connected, and are always spoken of as being of the American type. The design was made in England under the supervision of Sir Benjamin Baker, and may properly be described as of the American type, with English details. The result is curious, and to a certain extent, incongruous. The form of truss is the ordinary Pratt. The hip verticals are stiff members and nearly as heavy as the first parts. The lower chord is composed of ½ in. steel plates 12 or 15 in. wide. They are spaced on the outside and inside of the posts. The ends are reinforced by plates riveted on each side in order to give sufficient bearing surface for the pins. The diagonal web members, both main and counters, are broad, thin plates with the ends strengthened by reinforcing plates. These diagonal members are riveted together where they cross. A light 2-in. angle iron runs the whole length of the truss, and is riveted to the intersection of the diagonals and to each post.

The lateral bracing is one of the most peculiar features of the design. The floor beams are heavy, well designed, and riveted to the inside of the posts. The tops of the posts are connected by stiff members at right angles to the trusses. The lateral diagonals, both top and bottom, do not start from the panel points, but from points half-way between the posts. They are riveted to the cords and intersect opposite the panel points where they are riveted to the floor beam in the lower system and to the brace between the posts in the top system. The bottom chord is latticed and stiffened in the center of each panel where the lateral diagonals are riveted to it.

What the advantages of this peculiar lateral system may be, I am unable to understand, and the cross strain that it will bring to bear upon the chords at their center panel points appear to me to constitute a very grave defect. There is this to be said, however, in regard to the actual safety of this particular bridge. The spans are only 200 ft. The train load used in the designing is many times heavier than the bridge will ever be called upon to bear, and the allowable strain, per unit of area, was small. Therefore, notwithstanding the peculiarity in some of the details, the bridge has undoubtedly a very large "factor of safety." There were eight proposals received for this bridge, one only being American.

At present the shop facilities at Shan-Hai-Kuan are such that all girder work up to 100 ft. is done by the railroad company. In order to prevent scouring, many of the waterways are smoothly paved with large concrete blocks—the concrete in many cases being cheaper than stone. The dimensions of these blocks are about 3 by 1½ ft. by 1 ft. thick and their composition one part English portland cement to 16 parts of coarse river gravel and sand.

Just before reaching Shan-Hai-Kuan, the line runs across a line about one mile wide. The valley has considerable fall at right angles to the track. During the dry season, a small and insignificant looking stream meanders down this valley and passes under a bridge having an opening of over 1,000 ft. The roadbed was 8 or 10 ft. above the bottom of the valley. Last year, the river rose 16 ft. above the ordinary high water mark, and, for six or eight hours, the whole valley was filled with a torrent that swept everything before it. When the water fell so that repairs could be made, no attempt was made to rebuild the embankment. The track was lowered to the natural surface of the valley as to offer no obstruction to any future floods.

To protect the road-bed, a width of 50 ft. on each side was carefully paved one foot below the natural surface. The earth was filled back and the space planted with bushes. As the high water lasts only a few hours at a time, and the amount of traffic small, such an expedient is allowable.

The cost of timber is so great that wooden trestles are out of the question. The station houses are all built of light, burned brick, plastered on the outside. The broad platforms are of stone or concrete filled in with earth and cinders.

SHOPS.

The main shops are at Tong-shan, and consist of shops for repairing of cars and locomotives and for the construction of rolling stock. At present, about 500 men are employed at Tong-shan, but when the shops are run to their full capacity there are 900 names upon the pay rolls.

The company builds all of its passenger and freight cars, and also the tenders of locomotives. The sides

and roofs of the cars are of Oregon pine, and the framing timbers are of teak. The underframing of both cars and tenders is of mild steel.

These shops are directed by Mr. Churchward, who has been in charge for eight years, and thoroughly understands the needs of the road.

The locomotives are all English and Scotch, with the exception of one American one built by the Grant Locomotive Company. The engines are of the Mogul type. They are fitted with powerful steam brakes on the drivers. The greater part of the freight cars are open, with fixed sides about 4 ft. high. There are a few box cars with steel frames covered with thin plates. All cars have two 4 wheel trucks. The truck frames are of iron, excellently designed and made by the company.

American cast iron wheels have been tried, but did not give such satisfactory results as steel tire wheels from Europe.

The passenger cars are of an inferior quality as regards comfort, but they are superior to the treatment they get from the natives. Every car has a brake at each end, worked by a screw. As yet, no continuous brakes are used, although two trains were once fitted out with the Westinghouse brake. Owing to some trouble, the directors failed to adopt the system.

There is one detail of the rolling stock that is American—all cars have the Janney coupler. It is a source of regret to the general manager that he cannot manufacture this indispensible article, but must pay the American price for it.

WAGES.

Foreigners, of course, get much more than natives, but no more than the same class of men receive at home. Most of the engine drivers and mechinists are natives, and do good work. A common laborer gets $4 (Mexican) per month: firemen, $5 to $6: engine drivers, $14 to $45. At present, the two highest paid native drivers on the road get $41 and $46, respectively. An English driver can get, as maximum wages, $200 (Mexican) per month; a section hand gets $4; a foreman, $6; a native clerk $80, if he can speak and write both English and Chinese.

All the work possible is piecework. The trains are run by the English staff system, and only one train is allowed in a block.

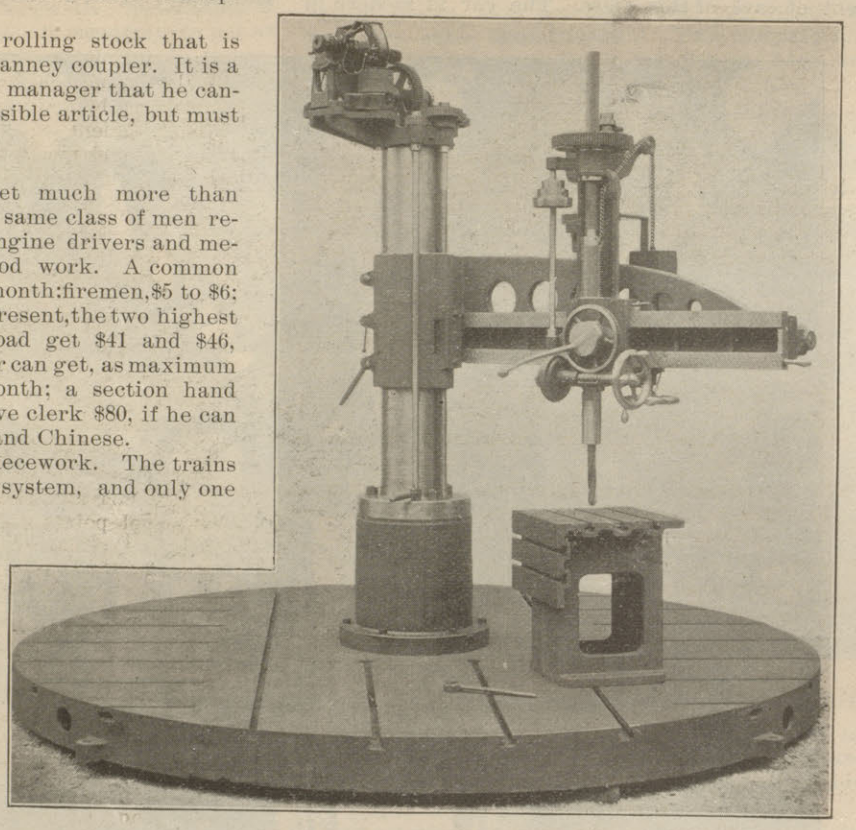
At present, all construction is at a standstill; nothing is being done except to keep the few trains necessary running. What the future policy will be as regards railroads no one can tell. Certain lines will eventually be built. The Chinese government already sees the necessity of connecting Peking with the Yangtze Valley. Prejudices, lack of funds, internal dissension, and jealousies between viceroys are some of the factors that have to be dealt with before we can see on foot any organized system for the further construction of railroads. At present, the outlook is gloomy, but there are rifts in the political clouds, and in time, the sun of prosperity and progress may break through.—[Sheridan P. Read, Consul at Tien-Tsin.

ELECTRICALLY DRIVEN RADIAL DRILL.

The use of electricity for driving metal working machines is rapidly becoming more universal in all lines and many recent applications are exceedingly neat and novel but one of the most attractive and practical which has come to our notice is shown in the accompanying illustration which is reproduced from a photograph of a radial drill built by the Bickford Drill & Tool Company of Cincinnati. The drill is the regular standard machine manufactured by the company but instead of being driven by a belt from a cone placed at the base of the column as is customary, a Crocker Wheeler electric motor is mounted on top of the column and geared to the upright driving shaft. The armature shaft carries a rawhide pinion which engages a spur wheel keyed to a horizontal shaft carrying a mitre gear which drives a vertical shaft in the rear of the column. From this vertical shaft the power is transmitted by gearing to a horizontal shaft on the back of the arm and from that shaft to a vertical shaft which drives the spindle. The arrangement of shafts is the same as on a belt driven machine, the upright shaft alongside the column being driven by the motor instead of by a cone and belt. The only belt on this machine is the small one for the feed on the head.

The absence of belts and cones makes it practical to swing the arm through a complete circle and operate on material placed at any point within the radius of the arm. With this object in view the base plate has been made circular in form and of a diameter equal to double the length of the arm. This enables the operator to literally cover the base with work to be drilled and get at any of it by simply swinging the arm. This arrangement must greatly increase the maximum output of the machine as the operator can devote his entire time to drilling, and one or two gangs of helpers can be employed at setting up the work ready for drilling and taking it down after it is finished. On some kinds of work this would mean multiplying the output many times as it frequently takes much longer to prepare and set a piece than it does to drill it. On heavy work which must be handled by a crane the ordinary drills will frequently stand still a larger proportion of the time than it will be running, but with this design it would be kept at work very nearly all of the time.

The base plate of the machine is heavy and deep, ribbed and braced on the under side so as to avoid danger of springing. The column, with the large, round base, is bolted to the bottom plate, and over this column, with a long bearing on the top and bottom, is fitted the outside sleeve which carries the arm. This arrangement makes the machine very stiff and rigid. The sleeve rests at the bottom, on a large flange, and is fitted with three clamping bolts. The rotating arm, which fits over the sleeve is of box form, strongly braced on top and bottom, and is raised and lowered by power. The flange of the sleeve is provided with a roller bearing which allows the arm to swing with perfect freedom. The spindles are counterweighted, have powerful automatic feed, and are fitted with the Bickford patent quick return motion.



RADIAL DRILL—BICKFORD DRILL & TOOL COMPANY.

All shafts and spindles, likewise the worms and worm rings are made of steel. All gearing is cut from the solid and main gearing made of steel.

The back gear is placed directly on the head, and can be engaged while the spindle rotates. In the same manner they can be disengaged, and the direct gearing thrown in while the machine is running, which arrangement makes it it easy to stop the spindle without reaching to the shifter. It is claimed that this arrangement is not found on any other drill on the market and that it enables time to be saved. It is also claimed to be convenient, and practical reducing the wear and tear of the machine, the strain being directly on the spindle and taken away from the usual long transmitting shafts and journals.

ECONOMICAL DESIGNING OF TIMBER TRESTLES.

In bulletin number 12 of the Division of Forestry of the United States department of agriculture the subject of economical designing of timber trestle bridges is treated in an interesting way by Mr. A. L. Johnson civil engineer. The paper is accompanied by two appendices one by Mr. G. Lindenthal and the other by Mr. Walter G. Berg. The following gives the principal parts of the paper and a summary of Mr. Lindenthal's comments theron. The comments by Mr. Berg are presented in the editorial columns of this issue.

PRESENT PRACTICE.

Many of the railroad companies now use a safe load of 1,000 lbs. per square inch for the modulus of rupture for long leaf pine stringers. The caps, sills, and posts are usually 12x12 in., irrespective of load.

Fig. 1 represents a common type of construction designed by the above considerations

The formula for bending is.

$$M=\frac{R\,b\,h^2}{6}$$

M=bending moment in pounds per square inch.
R=safe load on extreme fibre in pounds per square inch.
b=breadth of beam in inches.
h=hight of beam in inches.
Transformed, this becomes

$$b=\frac{6\,M}{R\,h^2}$$

Substituting the values for these quantities, we have

$$b=\frac{6\times 98{,}600\times 12}{1{,}000\times 289}$$

where the hight is assumed for trial.

This will make three stringers under each rail, 8¼ x 17 in. in cross section, posts, caps and sills all being 12x12 in. cross ecction.

The following factors of safety are indicated by their practice.

Stringers in cross breaking	7.6
Stringers in deflection 1-200 span	3.1
Stringers in bearing value	2.7
Cap, bearing value under stringers	1.5
Cap bearing value under posts	1.9
Posts crushing endwise	24.6

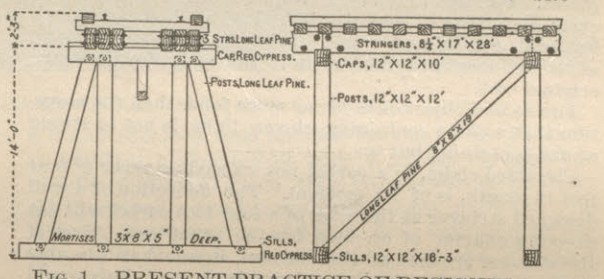


FIG. 1.—PRESENT PRACTICE OF DESIGNING.

Referring to Fig. 1 which is an example of present practice.

Number of feet B. M.	2,046
Cost of lumber	$22.25
Cost of iron	$2.86
Total cost of panel	$25.11
Iron, weight of	80.6
Iron, cost of	2.86

Figs. 2 and 3 show design recommended by the forestry division, that in Fig. 2 being preferred, though slightly more expensive than that in Fig. 3. These diagrams illustrate an important point, i. e., that the economical design of timber structures requires the judicious employment of different species as well as different sizes, in the same.

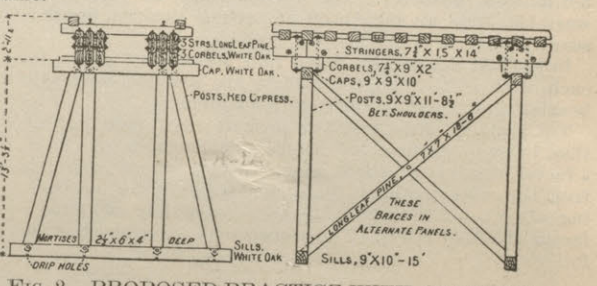


FIG. 2.—PROPOSED PRACTICE WITH CORBELS.

RECOMMENDED PRACTICE.

With corbels:

Factors of Safety

Stringers in cross breaking	5 +
Stringers in deflection 1-200 span	2 +
Stringers in end bearing	4 +
Cap in bearing value	3 +
Posts in endwise crushing	7.4+

For Fig. 2 the total cost of one panel is $30.13.

Without corbels:

Stringers in cross breaking	5 +
Stringers in deflection 1-200 span	2 +
Stringers in end bearing	3 +
Cap in bearing value	3 +
Posts in endwise crushing	7.4 +

For Fig. 3 the total cost of one panel is $19.45.

Assuming a hight of 14.5 in. for stringers the necessary width under each rail is equal to 21.8 in., making three 7¼x14½ in. by 14 ft. long. From Table VII we see that the length of end bearing or grip on the cap necessary for these stringers is 6 in. +30 per cent=6 in. × 1.3=7.8 in. To provide for weathering the stringers are increased ½ in. on each cross sectional dimension, making three pieces under

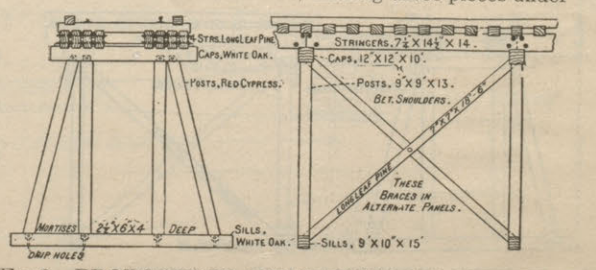


FIG. 3.—PROPOSED PRACTICE WITHOUT CORBELS.

each rail 7¾x15 in. by 14 ft. long. Now, since 7.8 in. grip are required for the grip on the cap, either a corbel must be used or the stringers given a full bearing on the cap.

A corbel is deemed best for this case, as it has several advantages, among which are the following:

1. It not only supports but unites the abutting stringers, forming a portion of the bond between them.

2. It stiffens the joint, materially decreasing the strain in the stringers.

3. When employed single span lengths of stringers may be used, these being cheaper and more readily furnished than the double span length. The double span length is, of course, better.

4. Large beams, which stringers usually are, are particularly liable to shear along their neutral axis. They will fail in this manner at less than half the shearing strength per square inch, as indicated on a small test. The reasons for this are: 1. That a large beam is apt to contain a portion of the heart center of the log which is likely to be ring shaken; 2. with old trees—and the trees from which such sizes are cut are usually old—the heart center is much below the average quality of the cross section; 3. large pieces are particularly liable to check in seasoning. Now, the bolt through the corbel and stringer does excellent service in increasing the resistance to failure by shearing. In fact, even when corbels are not used, a bolt through the ends of the stringers would be a wise precaution. It would be necessary, however, to tighten these

occasionally until the timber had thoroughly seasoned.

5. Corbels in many cases furnish the only means of obtaining sufficient bearing value for the stringers.

Many companies will not use corbels, claiming:

1. That they increase the cost in labor, lumber and iron.

2. That they increase the number of joints, and hence the number of places for the beginning of decay.

3. That they do not, after all, increase the bearing area of the stringer, since as the latter deflects, the whole load is brought upon the ends of the corbel.

With regard to the first item, by comparing the cost of designs shown on Figs. 2 and 3 we see that the corbel design costs in material 68 cents more per bent. The additional cost in labor would be very nearly offset, probably by the greater facility in handling smaller and fewer pieces. Perhaps 75 cents would be a fair estimate of the extra cost of corbel construction. It gives, however, much better structure, and would undoubtedly secure enough additional length of life to more than pay for the extra original cost.

The second objection is of no more force than the assertion that a chain containing eleven links is not so strong as one containing but ten.

The third claim, in a corbel not exceeding three of four feet in length, is of no moment. The deflection of a well designed stringer at the end of a four foot corbel will not exceed a quarter of an inch for the proof load. Even if the stringer crushed all this amount, it would still be able to crush as much more before being in danger. This would

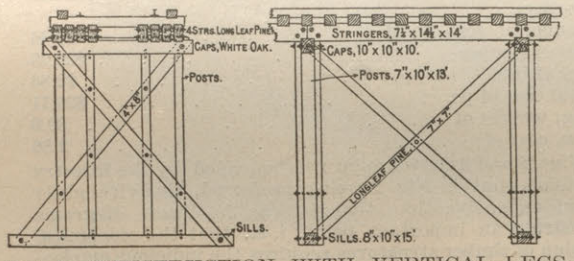


FIG. 4.—CONSTRUCTION WITH VERTICAL LEGS.

not happen, however. The corbels may be beveled toward the ends an eighth of an inch if desired, but it is scarely necessary.

In the last design, by using four stringers 7¼x14½ in. each, with a 12 in. cap, the corbels are avoided, sufficient bearing area being obtained without them.

The posts in these last two designs are much lighter than those in the first, but before weathering begins have a factor of safety of about nine. Taking off one-half inch from the cross sectional dimension to allow for weathering, after being in service for some years they still have a factor of safety of 7½. The dimensions were obtained as follows:

Assuming four posts in the bent we have $\frac{91.800}{4}$ (22,950 lbs.) to be carried by each post, or 11.48 tons. These posts will be about 11 ft. 8 in. long and have a ratio of $\frac{l}{d}$ =about 20 probably. We find that for this ratio a 7x7 in. long leaf pine post will suffice.

With an oak cap, the safe bearing value of which is 400 lbs. per square inch, we will require an area of cap and sill at the end of each post of $\frac{22,950}{400}$ = 57.4 square inches. Adding to this the mortise area we have 72.4 sq. in., which will require a post a trifle over 8.9 in. square. Then adding a half inch dimension to allow for weathering, we have a 9x9 in. post, requiring caps and sills of the same size. But with posts of this size we may use cypress or any of the weak, cheap, but durable timbers.

The designs in Figs. 2 and 3, though capable of carrying twice as much load as that shown in Fig. 1, show a saving of $5 per span, equal to 36 cents per linear foot of track, and 28 per cent less timber.

Assuming that this would be representative of one-half the total mileage of timber trestle bridges, i. e., 1,000 miles

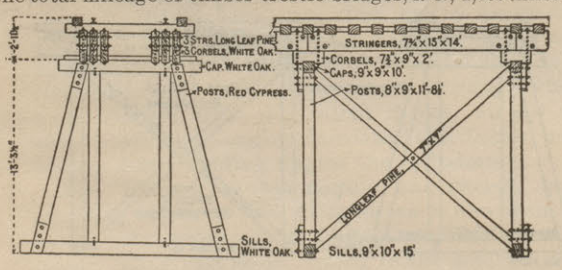


FIG. 5.—WITH VERTICAL AND SLANTING LEGS.

we have a total saving every nine years of $1,900,000, which is equal to an annual expenditure of $211,000. This capitalized at 4 per cent gives a capital of $5,275,000. These 1,000 miles of trestle use annually about 120,000,000 ft., B. M., of valuable timber, 35,000,000 ft. of which might readily be saved.

The tables of cost accompanying these designs upon which the above figures have been based are, of course, subject to great modification, depending upon the location, condition of the market, etc. It is thought, however, that they give a fair representation of the average conditions.

After speaking of the fact that only recently had the work of designing trestles been undertaken by engineers, Mr. Lindenthal comments upon the fact that trestles have always been treated and considered as temporary structures and shows that in fact they never lose their temporary character from the necessity of frequent renewal. He refered to the "stupid disproportion in the strength of columns, caps and sills" and considered it fitting that attention should be called to this. He discouraged the use of tenons and submitted sketches showing what he believed to be better and cheaper construction than that suggested by Mr. Johnson. Fig. 4 has vertical posts which are easy to fit and the dowel pins render it possible to save labor and increase the bearing. An arrangement upon the same plan for two vertical and two slanting legs is shown in Fig. 5. The following is quoted from Mr. Lindenthal's criticism:

"The detail of corbel bearings, as provided in Mr. Johnson's design, is to be commended; but I would not commend using short stringers the length of only one panel. The stringers should always be the length of two panels, with alternating joints in the two, three, or four stringers under each rail, as may be found necessary.

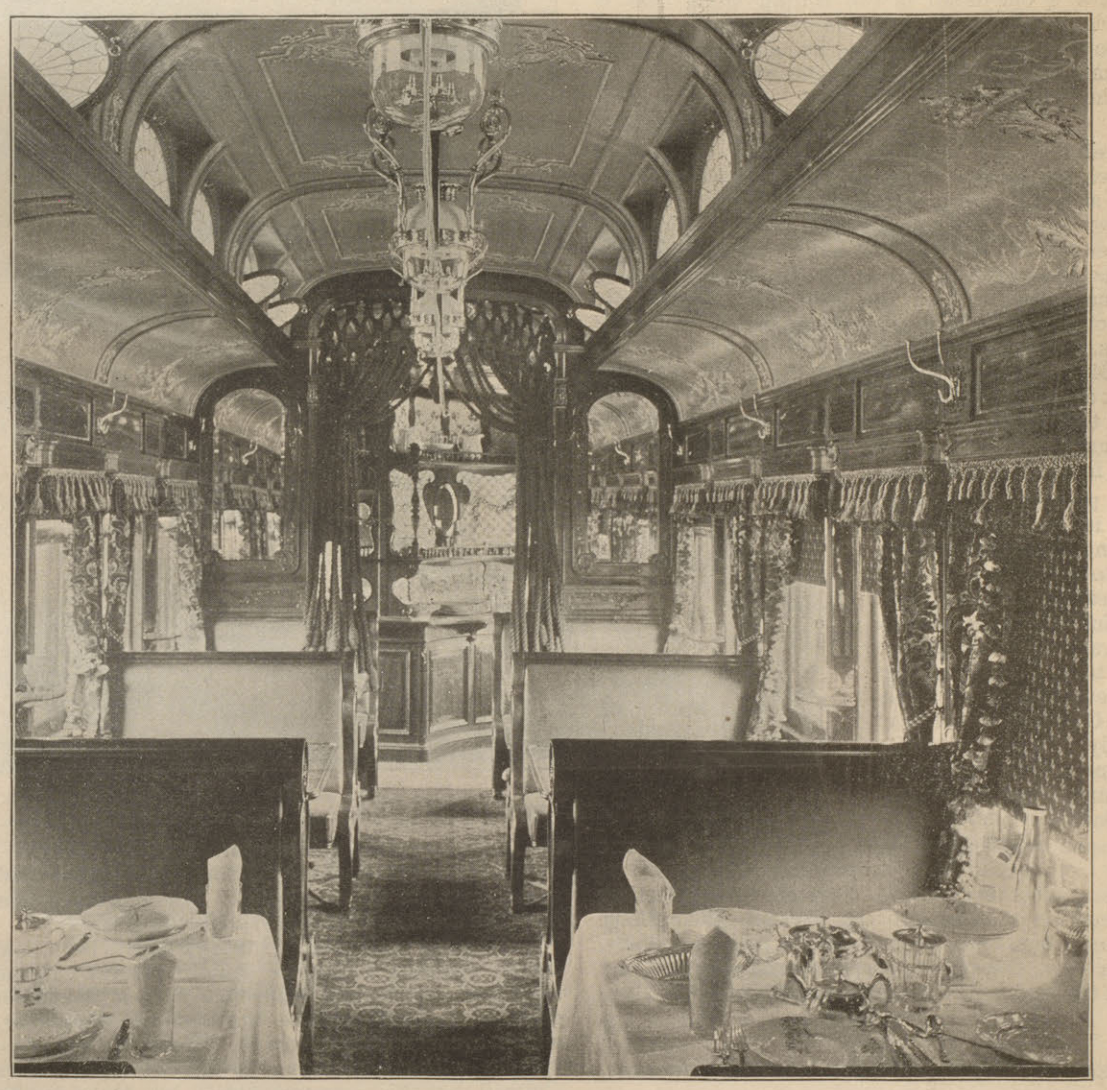
"One point to be watched in trestle construction is to prevent the lodgment of cinders in the structure, which would set it on fire. The cinders will usually lodge between the ties on top of the stringers or between the stringers on top of the cap. * * * *

"As regards longitudinal bracings between trestle bents, no general rules would be applicable. It would always depend upon the local considerations. When the trestle is high or on a curve or on uncertain bottom, special provisions of bracings will have to be made.

"It may not be amiss to say—although not directly connected with the subject under discussion—that no better way of economizing timber in the construction of railways could be devised than doing away with trestles altogether."

ATLANTA & WEST POINT DINING CAR.

The accompanying illustration is reproduced from a photograph of an interior view of a dining car recently built by the St. Charles Car Company for the Atlanta & West Point Railway and gives a very good idea of the appearance of the highest development of cars of this class. The car is modern in



DINING CAR—ATLANTA & WEST POINT, BY THE ST. CHARLES CAR COMPANY

every respect having the latest form of deck and ventilators. It is lighted with Pintsch gas and the decoration and wood work are neat and in good taste. The car is carried on six wheel trucks and is equipped with vestibules.

DISTANT SIGNALS AND CARE OF INTERLOCKING APPARATUS.

To the Editor of the Railway Review:

Your several editorials on interlocking and signaling and more especially your comments on the operation of the distant signal in connection with the protection of grade crossings so effectively set forth in your editorial of December 14, 1895, page 694 have attracted the writers attention. Sometime since several accidents of similar nature to that described in the editorial were brought to my attention and it emphasized the necessity of either controling the distant signal in some manner so as to prevent the operator throwing the home signal to danger immediately in front of fast approaching trains, or of operating the distant signal under different rules. It seemed to me that this was a very important matter which was not appreciated or considered by those in charge. I endeavored to get this subject before the public in an article published in the Engineering News February 15, 1894, in which I recited a case similar to that noted in your editorial first mentioned. I took the following position.:

"We may insure safety by taking the power of changing signals from the operator after a train has entered the limits of the interlocking by electric locking through the agency of the rail circuit, or by some mechanical device operated by the movement of the train."

The position taken by me was opposed by some of the engineering papers and a few signal engineers on various grounds. I have found, however, that the operating departments of railroads are almost unanimous in declaring that it is absolutely necessary to provide some means of guarding against the fallibility of human agency, and several of the trunk lines of this country now require in their specifications for a complete interlocking plant, that all distant signals shall be so controled by electric locking as to prevent the operator from changing same until train has entirely cleared the crossing. I also contended that if the railroad companies were not willing to completely finish plans by so controling the distant signals, it would be far better to do away with the distant signal altogether and substitute for it a post bearing a sign indicating its position relative to the home signal or crossing; enginemen upon seeing this post would be advised as to his distance from the crossing. Or else the distant signal should be operated under a more positive rule: that is, the engineer should not be permitted to pass the distant signal at danger unless he first brings the engine to a full stop and proceeds only in case he has a clear vision of the home signal.

It is held by some that such a rule would delay traffic to such an extent as to greatly reduce the capacity of the road. I cannot see the force of this argument for the reason that it is very infrequent that trains of the same class approach a crossing outside of cities at exactly the same time, and the only delay which would be caused would be by holding the train at the distant signal instead of the home signal in case the distant signal is operated as a positive block, and this would only occur when another train had been given and had accepted the opposing signals. I will not attempt to go into this subject further, but wish to say that I am somewhat pleased at the advance made in the consideration of this subject.

Your remarks on the maintenance of interlocking apparatus in the issue of December 21 are also of great interest. As you probably know, I have viewed the subject of signaling from three points: First, in the position of chief engineer of a railroad corporation; second, as consulting engineer of a railroad commission, and third as a designer and manufacturer of signal appliances, and while I may no doubt be accused by some of viewing it at the present time only in the light of personal interest, I trust and believe that others will credit my utterances with sincerity.

The installation of a plant is generally very closely inspected and it would appear that this close supervision would be continued after the same was put into operation. My experience is, however, that this is not done, mainly for the reason set forth in your editorial; that is, that the railroads do not

employ a competent signal engineer and the plant which has cost a considerable sum to install and which puts upon the railroad company interested a constant fixed charge, which if capitalized at 5 per cent would in the smallest interlocking plant equal a yearly investment of $25,000, is permitted to deteriorate and in many cases become a dangerous machine instead of a protection. The necessity of careful installation has been very strongly impressed upon me, so much so that I have made the requirements of our specifications for installation of facing point switches as follows:

"Each facing point lock to be fitted so that it will not be possibie for plunger to enter hole of lock rod if switch or movable point frog is 3-32 of an inch open in either position."

You will appreciate, I think, that to secure this result the entire mechanism must be manufactured and installed with great accuracy, and in order to maintain it in this high state of efficiency a continual watch must be kept over all of the various connections, and I believe in few cases is this done.

Another very important matter which I have expected you to touch upon in your general remarks on signaling is the amount of duty put upon each lever. Some persons having in charge the installation of interlocking seem to consider it economy to put as much duty on each lever as it can be made to perform through the power of human agency, and it is not an uncommon thing to see two levermen straining on a lever in their effort to move the switch, movable point frogs or detector bars, or possibly all three to which it is connected. And, so little is this matter considered by some that I was asked by a superintendent of a well known railroad in the east to provide plenty of room in the front of the machine between it and the face of the tower so that the assistant leverman could get around in front of the lever and help push. This may appear amusing but it is in fact serious, for the reason that the strain brought upon all connections, foundations, etc. is such that high efficiency and accurate adjustment cannot be secured and the false economy of so overloading levers is apparent to any one who will consider the subject for a moment. Another point to be considered is the number of levers that an operator should have to manipulate in order to set up any of the various routes in the shortest possible time and with the least number of steps and movements of the levers.

It is now the general practice where a new railroad is seeking to cross the tracks of an established road, to require the new company to put in an interlocking plant, and since the new company in most cases has for its object the getting of the crossing, the officers in charge generally stipulate for the cheapest possible plant which will permit them to "skin through", and in several cases I have had to refuse contracts for installation of such plants for the reason that we would not be permitted to put in the protection necessary.

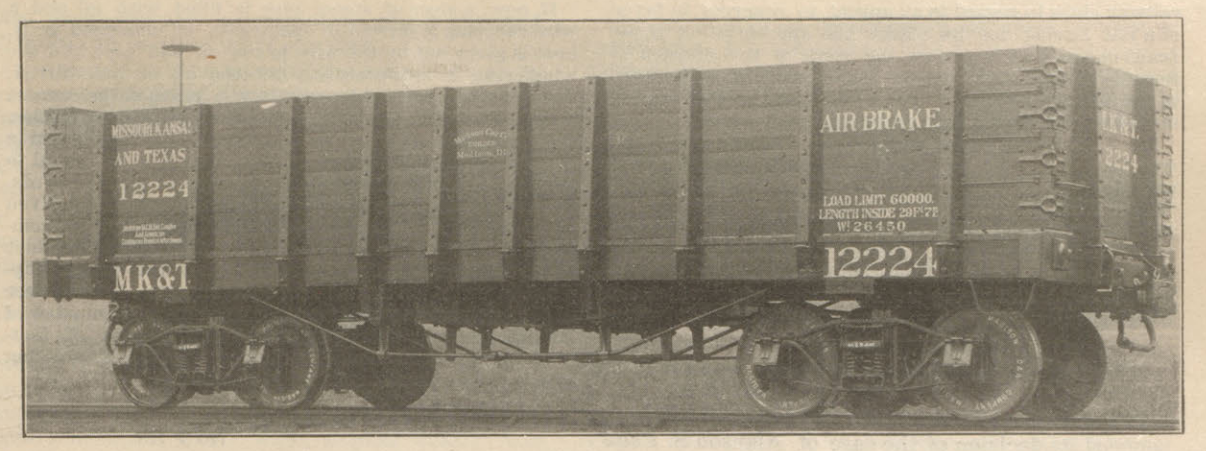
CHARLES HANSEL.

[The question of the safety of distant signals as they are now used is properly attracting considerable attention and in support of Mr. Hansel's argument attention is called to a letter by the engineer of the commissioner of railroads of Michigan upon this subject, which appears elsewhere in this issue. An engineer of prominence in signaling matters recently wrote in regard to this point as follows: "The distant signal as now used is highly dangerous and must go, unless electric locking or different rules are introduced."

Mr. Hansel will see shat the subject of the overloading of levers has not been neglected as some data are now in preparation which will tend to show the falacy of the supposed economy of using too small a number of levers for the work which is required to be done.—[ED.

STANDARD 60,000 LBS. CAPACITY COAL CAR, M. K. & T. RY.

Through the courtesy of Mr. William O'Herin, superintendent of machinery and equipment of the Missouri, Kansas & Texas Railway, we are enabled to illustrate and describe the new 60,000 lbs. capacity gondola car recently built for that road by the Madison Car Works. Fig. 1 gives an idea of the exterior appearance of the car; Fig. 2 shows the truck and body bolster; Fig. 3 shows the brake rigging as attached to the trucks, and Fig. 4 is a sectional view through the sills, showing the body and truck bolsters. The length of the car over end sills is 30 ft.; the width over side sills is 8 ft 9½ in.; the hight from top of rail to the top of the side boards is 8 ft. 4⅛ in., and the top of the brake staff is 3 ft. higher than this. There are eight longitudinal sills of long leaf yellow pine, 5x10 in. in section. The end sills are of white oak, 7x12¾ in. The draft rigging is fitted with the American continuous draw-bar attachment, with a key or cross head of 1x5 in. iron 24 in. long, reduced at each end for the eyes of the draft rods, which are of 1¼ in. round iron. The draft timbers butt against the body bolsters and a 3x5 in. subsill is used under each of the center sills between the bolsters and the cross tie timbers. The couplers are of M. C. B. type of the Buckeye pattern, and they are equipped with



MISSOURI, KANSAS & TEXAS STANDARD COAL CAR.—FIG. 1.—GENERAL VIEW.

the Buckeye unlocking device. There are two draw-bar springs with 6½x8 in. coils of 22,000 lbs. capacity. The body bolsters are of pressed steel made by the Schoen Manufacturing Company of Pittsburgh. They are 8 in. deep in the center, 14 in wide and 8 ft. 9½ in long. They are supplied with pressed steel center plates, side bearings, truss rod struts, all from the same manufacturers. This company also furnished the corner bands for the car body, and sill and receives nuts and washers on its inside face. In addition to this a ¾ in. bolt is passed through the middle of the stake 2 in. from its lower end, which also received a washer and nut on the inside of the sill. A plate washer of ¼x3 in. iron is placed on the face of the stake for a bearing for the "U" and straight bolts. The top end of this plate is turned around the "U" bolt and the lower end is drilled for the ¾ in. bolt.

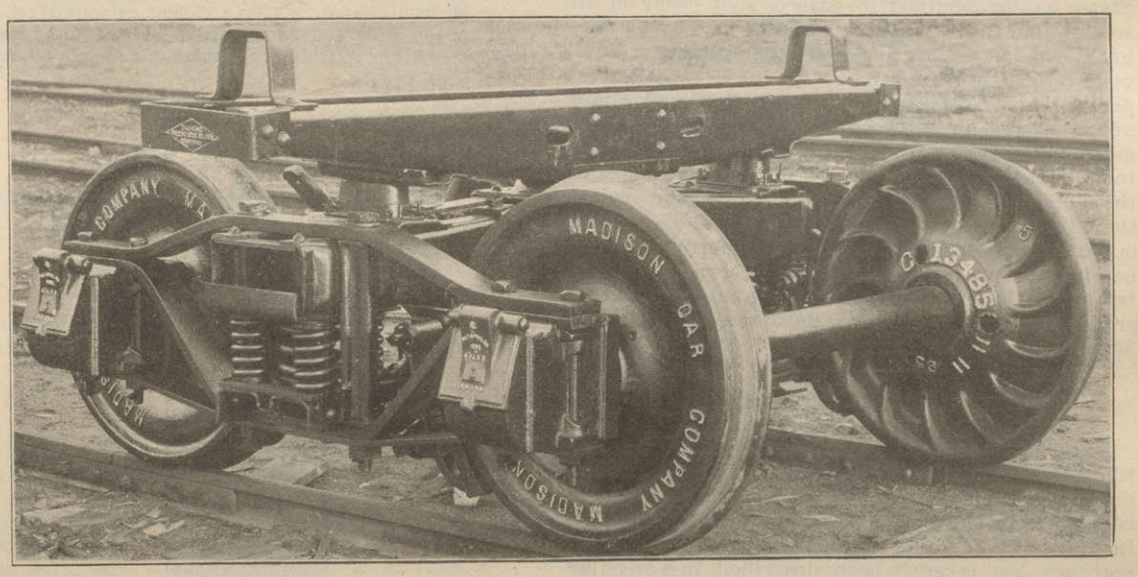


FIG. 2.—TRUCK SHOWING SCHOEN BOLSTERS AND CONSTRUCTION.

spring planks for the trucks. The truck is of the pattern known as No. 7 among the M. K. T. standards, The truck bolsters are 12 in. deep at the center and 7¼ in. deep at the ends.

Ten stakes are provided for each side and two stakes on each end of the car, the corners being strengthened by the pressed steel corner plates already mentioned, which are each secured to the siding by eight lag screws. The four side stakes at the

The trucks have the M. C. B. standard oil box with 1¼x8 in. journal, M. C. B. standard axle and 33 in. cast wheels. There is very little cast iron in the trucks, this material being used only for the oil boxes and wheels. Malleable iron is used for stop wedges and oil box lids. The axles, arch and tie bars are forged. The "King" yielding side bearings are used, and with this exception the spring plank, column guides, etc., are furnished complete by the

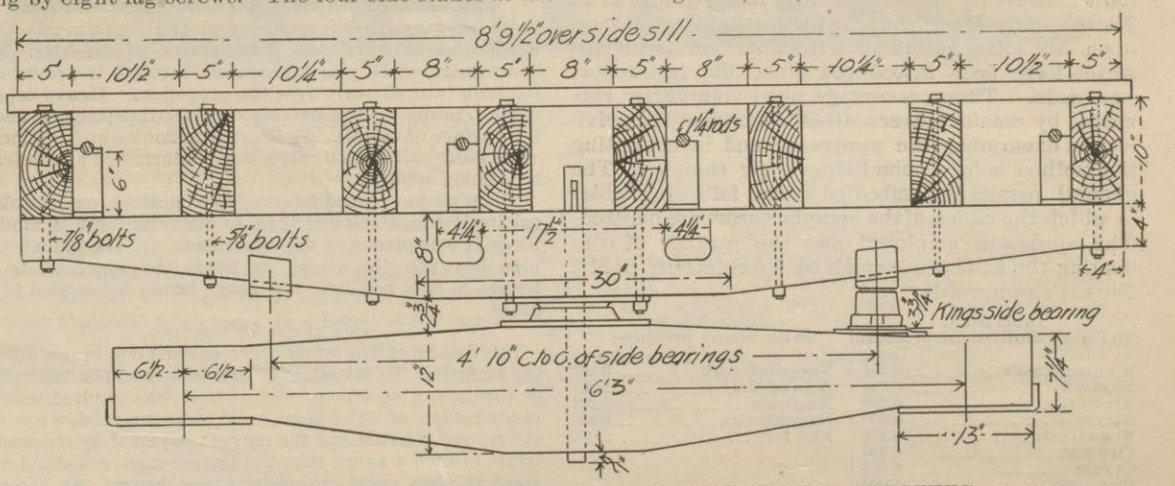


FIG. 3.—SECTION SHOWING SILLS, BODY AND TRUCK BOLSTERS.

cross tie timbers extend 9 in. below the side sills, in accordance with the suggestion made at the Alexandria Bay convention of the Master Car Builders' Association for the strengthening of coal car sides. The stakes are secured to the sills by means of a ¾ in. "U" bolt over the stake which passes through the

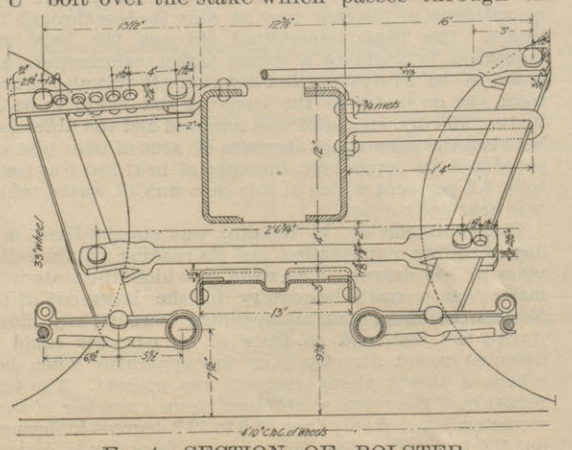


FIG. 4.—SECTION OF BOLSTER.

Schoen Manufacturing Company. The brakes are inside hung and employ the National hollow brake beam with M. C. B. standard head and shoe. The brake beam safety hangers are of pressed steel, furnished by the Schoen Manufacturing Company, as well as the brake hanger back breaker, the brake beam balance, and the dead lever guide bracket. The car is modern in every respect and is an example of good design in which lightness, accompanied by strength, has been sought and apparently obtained.

The Western Railway Club.

The March meeting of the Western Railway Club was held at the Auditorium Hotel, Chicago, on the 17th inst. The first business transacted consisted of continuing the committee which was appointed at the February meeting to consider the subject of the loading of long timbers and poles. A report of the committee having the recommendations of the club with reference to the revision of interchange rules in charge explained the work which had been done. Fifteen new members were received and a communication was read which had been received from Mr. Walter G. Berg of the Lehigh Valley Railroad, in which the club was urged to take action in company with othe

railway clubs in regard to an appeal to congress in favor of a bill having for its object the appropriation of the funds necessary to complete the work of the division of forestry of the United States department of agriculture in the testing of timbers. This resulted in the passing of resolutions urging the support of the measure.

Mr. J. N. Barr's paper, entitled the "Ninety and Nine" was then discussed by Messrs. Forsyth, Rhodes, Barr and Judson. The paper by Mr. G. L. Potter, entited, "Piece Work in Car Shops," which appears elsewhere in this issue was next taken up and was discussed by Messrs. Herr, Manchester, Barr, Rhodes, Atterbury, Harrison and Potter. A topical discussion was held upon the subject of rigid and swing motion trucks after which the meeting adjourned.

Ruling as to Rates on Window Shades.

The Interstate Commerce Commission has announced its decision of the case of Alanson S. Page and others against the Delaware, Lackawanna & Western Railroad Company, the New York Central & Hudson River Railroad Company and the Michigan Central Railroad Company, in favor of the com' plainants. The substance of the decision is as follows: An order having been issued by the commission in this case on March 23, 1894, requiring these carriers to discontinue their first-class rating of window shades and to cease and desist from charging more than third-class rates for the transportation of that commodity, and the circuit court of the United States having declined to enforce such order on the sole ground that it applied to shades having very high value as well as to the cheaper varieties, Held, upon rehearing before the commission, that the order of March 23, 1894, should be vacated and a new order entered containing the same general requirement, but with a proviso permitting the defendants to restrict their transportation of window shades at third-class rates to those on which the valuation at the time of shipment is limited to six dollars dollars per dozen or under, and also permitting the carriers to prevent excessive undervaluation for transportation purposes of the much more expensive grades of shades by such regulations as they may be advised are just and lawful.

STEAM PIPE COVERINGS.

Many contributions to information of high scientific character with regard to protection against accidental fires in connection with steam pipes, have been made by the Boston Manufacturers Mutual Fire Insurance Co., and not the least valuable of these researches has recently been described in a circular just received through the courtesy of Mr. Edward Atkinson, president of that company. A number of years ago, a careful investigation was made to show the relative danger of fire incurred by using various kinds of steam-pipe coverings which were liable to impairment by heat. These tests were made to enable this insurance company to speak with authority upon the safety of these non-conducting materials and while reports have been made from time to time giving the results of such work, perhaps the most interesting is one recently made by Mr. C. L. Norton, of the Massachusetts Institute of Technology, upon his examination of a number of coverings which have been introduced since the last report was made. These coverings were voluntarily submitted by manufacturers, all of whom had the privilege of examining the apparatus and investigating the method before submitting their samples. The general results are embodied in the following tables in which the names of the manufacturers are omitted. The apparatus employed and the manner of conducting the tests are explained substantially in Mr. Norton's own words:

Table No. 1.
200 lbs. absolute steam pressure

	Loss.
Nonpareil cork	0.254
Magnesia	0.284
Air cell 2	0.284
Air cell 1	0.300
Magnabestos	0.321
Fire felt	0.333
Calcite	0.423
Bare pipe	1.000

Table No. 2.
10 lbs. steam pressure.

	Loss.
Nonpareil cork	0.232
Air cell 2	0.261
Magnesia	0.262
Magnabestos	0.383
Fire felt	0.395

METHOD OF TESTING.

The methods usually employed and known as the "condensation method," and "outside temperature method," are both open to objections, especially the latter. The quality of the steam condensed, in using the former method, must either be determined or an assumption made that it is dry and saturated. Difficulty in determining and maintaining constant the quality and pressure of steam and the irregularity in amount of the drip from condensing surfaces led me to discard this method. The practical impossibility of applying a thermometer bulb to the outside of a pipe cover so as to obtain readings which check within several degrees renders the second method undesirable.

The following method was designed by me and used in these tests as being free from the errors and difficulties attendant upon the other methods. I find it has been previously used by F. A. Laws. When a steady current of electricity flows along a wire, all of its energy is converted into heat provided there are no accompanying magnetic changes, and the amount of heat so generated can be determined from the amount of electrical energy supplied to the wire. Of the heat thus generated, a part ordinarily raises the temperature of the wire, and the remainder is given out to the surrounding bodies by conduction, convection and radiation; but if the temperature of the wire remains constant, it is because the heat generated in it is all given off to the surrounding bodies.

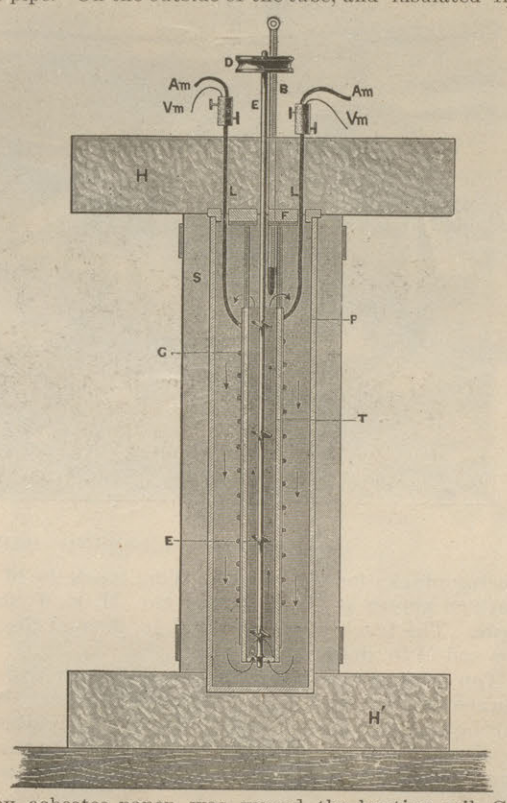
If, now, a piece of steam pipe is filled with oil and a wire carrying a current of electricity is immersed in it, heat is given out by the wire to the oil and pipe and the whole rises in temperature. Let the oil be well stirred, and when any desired temperature is reached the current may be gradually diminished until the temperature neither rises nor falls. When this condition of equilibrium is reached the heat furnished by the current is just equal to the heat lost from the outside of the pipe; or in other words, the heat put into the pipe is just equal to the heat given off by the pipe. The amount of heat may then be computed from the voltage and current used. The product of the volts and amperes gives the electrical energy supplied, in watts, 746 watts being equivalent to 1 horse power of 550 foot-pounds per second. To compute the number of British thermal units per second the number of foot-pounds per second should be divided by 778. Expressing this in a formula the relation is as follows:

$$\text{B. T. U per sec.} = \frac{\text{Watts} \times 555}{746 \times 778}$$

It will be seen that it is only necessary to take readings of a voltmeter and an ammeter to measure the heat lost from the pipe.

THE APPARATUS.

The form of apparatus adopted for this test was as follows, and is shown in section in the accompanying illustration. A piece of double thick 4 in. steam pipe P, 18 in. long, welded up at one end, and provided with a loosely fitting cover F at the other end, was placed in an upright position and filled with cylinder oil. A brass tube T 2 in. in diameter and 15 in. long, was suspended from the cover concentrically with the pipe and carried inside it on a vertical shaft, four propellers E. These when driven by a motor M from above, set up a violent current of oil, upward in the tube and downward outside of it and inside the pipe. On the outside of the tube, and insulated from



it by asbestos paper, was wound the heating coil C of manganine wire, having a resistance of 25 ohms. The thermomenter B was introduced through the cover and its bulb was directly over the propellers. Heavy copper leads L brought the current down to the heating coil under the surface of the oil. A Weston ammeter and voltmeter were used, calibration corrections determined at the institute being applied.

The pipe was placed in an upright position on a block of calcite H 4 in. thick and 12 in. in diameter, and a similar block H was placed on the upper end. On the 16 inches of pipe between the blocks or heads the specimen to be tested S was applied, the same heads being used in all cases.

PROCEDURE OF TESTING.

The details of the work were carried out in the following manner. To investigate the loss from the bare pipe, or through a specimen, the current was applied until a temperature of 381.7 degrees F. was reached, when the stirrer was started and the current adjusted by successive trials to such a value that the temperature remained constant at that point for about three hours. At the end of this time readings of current, voltage and temperature were taken once in 30 seconds for 15 minutes. In no case was there difficulty in adjusting the current so that the temperature should remain constant to within 1-10 degree in that time, and a variation of one-half of 1 per cent in the number of watts supplied caused the thermometer to fall or rise at the rate of 1-10 degree in a minute.

These readings give the loss of heat from the bare pipe, or specimen as the case may be, plus the loss through the heads. The heat transmitted through the head was measured by applying a water jacket calorimeter, and found to be equivalent to 3.1 watts. It was also figured from the geometry of the covering and found to be 3.0 watts. Thirdly, one head was removed and the difference between the percentage increase of area of bare pipe exposed and the percentage increase of heat lost was found to be 8.2 per cent which in this case was 3.1 watts, which was assumed correct.

The thermometer, by Baudin, was standardized each day in boiling naphthaline and its reading may be relied upon to 1-10 degree. The room in which the tests were made was a small laboratory in the basement of the Walker building, and all openings were tightly closed during the test, aud no trace of air currents could be detected except directly over the apparatus when hot, where a slowly rising current was present. The temperature of the room, as obtained from a number of thermometers, varied only from 72.0 to 72.7 degrees F. throughout the test. To detect any changes from day to day one particular piece of magnesia was applied every morning and tested, but no difference greater than one-half of 1 per cent was found between any two day's tests on this piece. The tests at the lower temperature were conducted in the same manner.

All specimens were cut to a length of 16 in., the greatest variation being less than 1-16 in. and although this is not a large specimen, the relative values, at least, are as accurate as if larger pieces were used. The final values of the ratio of efficiency may be depended on to one half of 1 per cent. From 5 to 15 tests were made on each specimen furnished, and none of the specimens of the same material differed among themselves by more than one-third of 1 per cent except the fire felt. The second set of samples of the air cell cover were thicker than the first set and the gain in efficiency is proportional to the gain in thickness. The second set of samples of fire felt were much softer and finer in texture and were stiffened on the inside with silicate of soda.

All specimens fitted the pipe closely and were carefully cemented at the joints and covered with canvas, using two wrought iron bands outside. The Nonpareil cork was an exception, however, in that it was used without canvas.

The question of the ability of the various materials to resist the action of heat for a length of time is of great importance, as is also the question of the effects of vibration and jarring. These matters are to be investigated at once, though the possibility of any of these materials being injured by jarring is very small. None of the specimens were affected disastrously by the heat of the tests except the "asbestos sponge," in which the sponge is completely charred for a distance of ⅜ in. from the pipe after an exposure of six hours. This test is therefore omitted.

There was a difference in thickness in the specimens tested, but none were far from 1 in. in thickness, and I am satisfied that were they all 1 in. thick the order of efficiency would not be disturbed. The measurements of the thickness showed variations of nearly 1-16 in. on most of the specimens.

LOUISVILLE (KY.) TERMINAL OF THE C. C. C. & ST. L. AND THE C. & O. RAILWAYS.

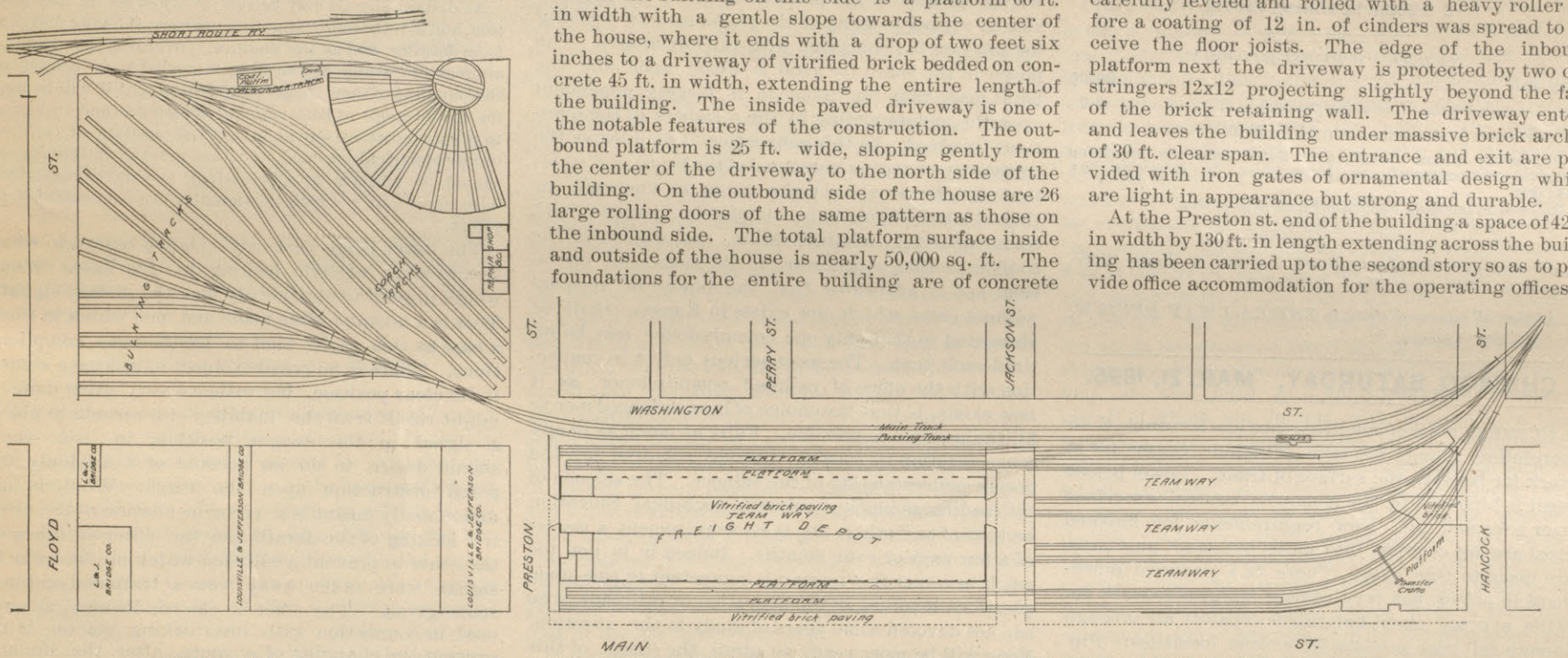
Through the courtesy of Mr. Geo. W. Kittredge, chief engineer of the Cleveland, Cincinnati, Chicago & St. Louis Railway, we are enabled to illustrate and describe the arrangement of the terminal of that road and that of the Chesapeake & Ohio Railway in Louisville, Ky.

Until 1895, the Cleveland, Cincinnati, Chicago & St. Louis Railway reached with its own lines within about fifty miles of Louisville. The completion of the Louisville and Jeffersonville bridge over the Ohio river gave this company a direct inlet with its own trains, after a trackage arrangement had been made with the Baltimore & Ohio Southwestern Railroad for the use of about fifty-three miles of its track from North Vernon to Jeffersonville, Ind. On June 29, 1895, the main track was completed across the new bridge and into Louisville, and in August 1895 the C., C. C. & St. L. Ry. began to run its own passenger trains into Louisville. The C. & O. Ry. has been and still continues to use the L. & N. R. Co.'s tracks for its entrance into Louisville, but upon the completion of a branch now under construction it will run its passenger and freight trains into the terminals owned jointly by the C., C., C. & St. L. Ry. and itself. The joint terminals are now nearing completion and may be briefly described as follows:

They cover three entire blocks in the center of the business part of the city and the plans for them were drawn under the direction of Mr. George W. Kittredge chief engineer of the C., C., C. & St. L. Ry. Co., and were erected and carried out under the supervision of Mr. O. E. Selby, resident engineer at Louisville. The terminals include an engine house of twelve stalls with the necessary buildings, such as boiler shop, storeroom, coal platform, etc.; a coach yard equipped with steam and water and all conveniences for taking care of the passenger equipment of both companies; two commodious yards for bulk freight; and a large freight house for the economical handling of a large amount of both inbound and outbound freight, and for the local offices of the road. The roundhouse is located near the corner of Water and Preston streets. It is built on foundations of concrete and vitrified brick, with brick rear and end walls, cast iron columns in front and flat roof covered with tar and gravel. The admission of light and the ventilation have been two of the points carefully considered in designing the work and the large doors, windows and transoms that have been used accomplish the desired ends. The house is divided into two parts by a fire wall extending above the roof, and in each stall is a pit 46 ft. in length from which the necessary drain pipes run, and in which are located coils of steam pipes. The turntable built by the Louisville Bridge & Iron Co., is 65 ft. in diameter.

A brick building on Preston street adjoining the roundhouse, serves the purpose of a small machine and blacksmith shop, car cleaners' room, storeroom, boiler room, etc. On the Water street side of the roundhouse are located the coal platform, sandhouse and ash pit. Of the two bulking yards shown in Fig. 1, the tracks on the eastern one leave the main track at the intersection of Hancock and Washington streets and occupy the entire block bounded by Hancock, Jackson, Main, and Washington streets. There are in this block nine freight tracks, arranged in groups so that six of them can be used for handling bulk freight from driveways paved with vitrified brick and lined with stone curbs. The other tracks in this yard are used

for storage and transfer business. At the corner of Main and Hancock streets is a platform for handling pipe, heavy machinery, and other freight too bulky or too heavy to be handled without the use of machinery. In connection with this platform is an overhead derrick so located that material can be handled to or from the platform onto cars, or transferred from one car to another, or handled from or to a team standing on one of the paved driveways to or from the car. Near the entrance of this yard are track scales of 60 tons capacity. The western bulk-



TERMINAL C., C., C. & ST. L. AND CHESAPEAKE & OHIO RAILWAYS—LOUISVILLE, KENTUCKY.—FIG. 1.—PLAN.

ng yard is located in the square between Washington, Floyd, Water and Preston streets. It consists of tracks arranged in pairs with driveways between them easily accessible from Floyd street.

The freight station itself, shown in Figs. 2 and 3, is probably the most noticeable of all the improvements within the terminals and is deserving of special mention. The building itself is 525 ft. long by 130 ft. wide and extends the entire length of the square between Main and Washington, from Preston to Jackson streets. On the outside of the building are four tracks, two on each side, separated from each other by platforms six feet in width, level with the floor of the cars. On each side of the building are additional platforms eight feet in width between the main building and tracks nearest it. The two tracks on the north side of the building are intended for outbound business and those on the south side for inbound business. The freight station is constructed in a most substantial manner of steel and brick and is replete with all modern improvements. It is large enough to accommodate the present business and so designed that at a small additional expense, large storage accomodation above the present floors can be afforded at any time.

Advantage has been taken of the nature of the site which has a slope of about four feet from Main to Washington streets to handle both in and outbound freight in the most economical manner. Twenty-six cars can be placed on the tracks adjoining the building on each side. On the inbound side there are thirteen rolling steel shutters of the pattern manufactured by Jas. G. Wilson of New York. Inside of the building on this side is a platform 60 ft. in width with a gentle slope towards the center of the house, where it ends with a drop of two feet six inches to a driveway of vitrified brick bedded on concrete 45 ft. in width, extending the entire length of the building. The inside paved driveway is one of the notable features of the construction. The outbound platform is 25 ft. wide, sloping gently from the center of the driveway to the north side of the building. On the outbound side of the house are 26 large rolling doors of the same pattern as those on the inbound side. The total platform surface inside and outside of the house is nearly 50,000 sq. ft. The foundations for the entire building are of concrete and vitrified brick and the exterior walls are built of stock brick laid in red mortar. On the office end of the building on Preston street, rock faced ranged ashler work is used as high as the top of the platforms.

The main roof of the center portion of the freight house, 482 ft. in length and 80 ft. span, is supported by two parallel rows of steel "Z" bar columns placed 25 ft. from the north and south walls. Between these columns and the outer walls the roof is flat and covered with paper and gravel laid on 2½ in. matched sheathing with a slope of one inch to the foot and supported on beams which extend ten feet beyond the walls, so overhanging the platforms that freight while being unloaded is protected from the weather. Between the rows of steel columns the main roof is carried ten feet higher than the side roofs. The columns are connected in a direction parallel with the length of the building by a series of steel eye beams which afford a support to a brick clear story wall pierced with numerous windows which from their position afford ample light to the interior of the building.

The main roof is composed of 25 steel trusses spaced 18 ft., 6 in. on centers and is covered by slate roofing with galvanized iron crestings and copper gutters. In the flat portion of the roof over the inbound platform are numerous skylights. The platform floors consist of 1½ in. maple laid diagonally with the length of the building. Under the maple is a floor of 1½ in. tongued and grooved yellow pine nailed to joists imbedded in dry cinders. The space under the floor was filled solidly with earth and was carefully leveled and rolled with a heavy roller before a coating of 12 in. of cinders was spread to receive the floor joists. The edge of the inbound platform next the driveway is protected by two oak stringers 12x12 projecting slightly beyond the face of the brick retaining wall. The driveway enters and leaves the building under massive brick arches of 30 ft. clear span. The entrance and exit are provided with iron gates of ornamental design which are light in appearance but strong and durable.

At the Preston st. end of the building a space of 42 ft. in width by 130 ft. in length extending across the building has been carried up to the second story so as to provide office accommodation for the operating offices in the freight and transportation departments. The entrance into the office is on Preston street up a flight of cut stone steps passing under a large arch way. On the ground floor offices have been provided for the cashier and shipping clerks with fire-proof brick vaults, toilet rooms, lavatories, etc. In the second story is an ample hall way and offices to accommodate those who cannot be taken care of below. The facade on Preston street presents a handsome appearance, above the rock faced ranged ashler it is built of selected stock brick with cut stone belt courses and trimmings.

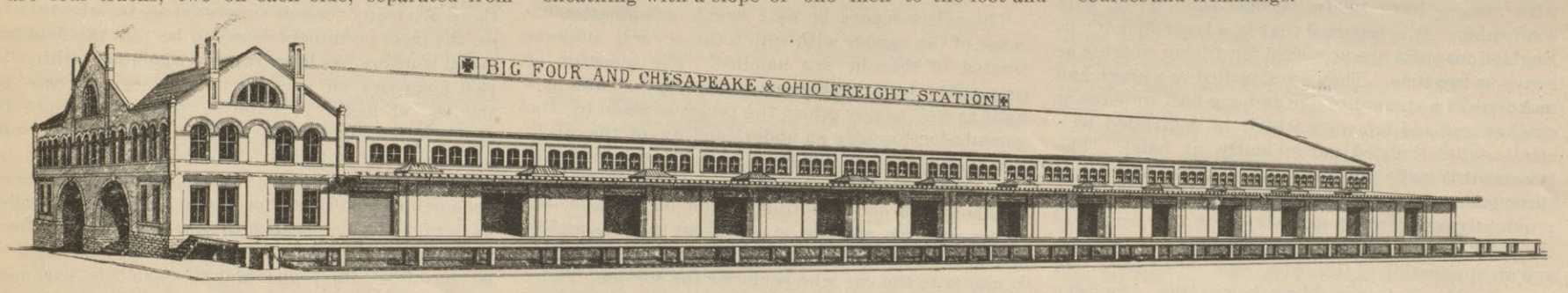
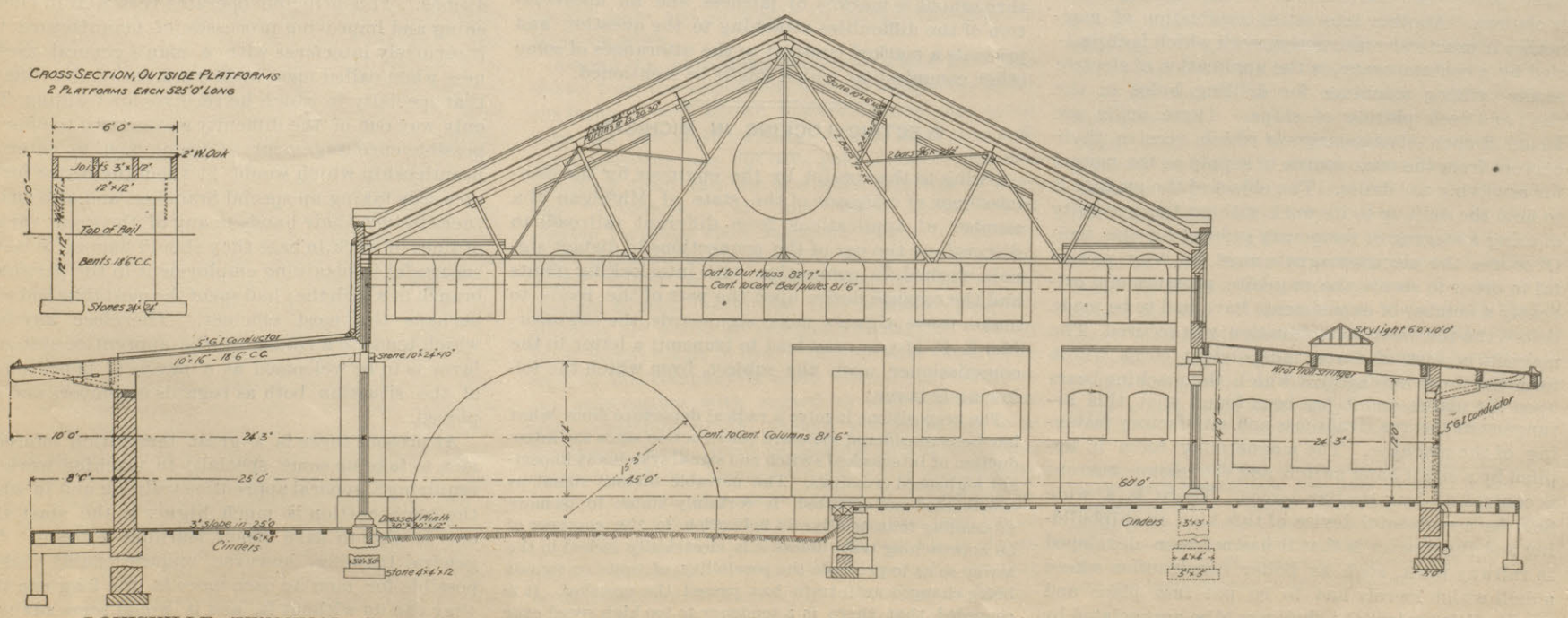


FIG. 2.—FREIGHT HOUSE AND OFFICES, DESIGNED BY MR. G. W. KITTRIDGE, CHIEF ENGINEER.

The C., C., C. & St. L. R. Co. opened its freight business on January 2 in the new house just described and it is expected that the C. & O. Ry. Co. will before long run its own trains into the same terminals and use the same buildings and tracks now used by the C., C., C. & St. L. R. Co. Taken altogether, the terminals within the city of Louisville can be classed as modern terminals of the most approved design and have been so planned and constructed as to meet the requirements in the best possible manner.



LOUISVILLE TERMINAL C., C., C. & ST. L. AND CHESAPEAKE & OHIO RAILWAYS.—FIG. 3.—SECTION THROUGH FREIGHT HOUSE.

THE RAILWAY REVIEW

OFFICE OF PUBLICATION:
The Rookery, - CHICAGO, ILL.
Eastern Office: 189 Broadway, New York.

TERMS OF SUBSCRIPTION:

Per Year $4.00
Foreign Subscription (including postage) 5.0

Convenient binders sent postpaid for $1.00.

PUBLISHED EVERY SATURDAY: Subscribers are requested to give information of any irregularity in receiving THE REVIEW.

Rates of advertising made known on application.

All remittances should be by Draft, Express, or Money Order, payable to THE RAILWAY REVIEW.

Address all communications to THE RAILWAY REVIEW, Rookery, Chicago.

CHICAGO, SATURDAY, MAR. 21, 1896.

CURRENT market conditions are less favorable than heretofore, though the same favorable causes are at work far beneath the surface of trade. Lower priced steel is hindered by the monopoly control exercised over coke and ore. New requirements for finished steel are not crowded into mills, but small purchases are made to tide over. There is a pressure downward in prices, but very narrow margins to work on. Mills average about two-thirds capacity all through though full time prevails in favored localities. Piping of all kinds is active. Bar mills are doing well. Plate and structural iron makers have inquiries that promise to engage full early summer capacity. There is a silver lining in the clouds. If we cannot buy and build a contract for work as much as we would like we can execute every preparatory step and then quietly bide our time, which we have done and are doing.

IT IS interesting to know that electro-magnets which were introduced several years ago for the purpose of handling magnetic materials in connection with cranes have again become popular in this connection. It is reported that in a large foundry in England magnets are now used for lifting weights as heavy as two tons. They are attached to a crane and make use of a current of five and one-half amperes at one hundred and ten volts which is controlled by a small switch located conveniently at hand. The statement is made that with one of these appliances three men can do in fifteen minutes the work which previously occupied six men six times that length of time. It may be remembered that about four years ago an application of this idea was illustrated in a paper by Mr. H. C. Spaulding before the American Society of Mechanical Engineers. In this instance a load of nearly five tons was held by a magnet weighing one thousand pounds through which a current of not quite five amperes at two hundred and sixteen volts was passed. This magnet was suspended to a crane and was found especially useful in handling pig iron, castings and boiler plates and owed its success and popularity to the speed with which it would pick up and let go of a load. The controling device is simple and consists of a make and brake switch which may be located on the magnet itself or any desired part. The convenience of this arrangement is obvious. Another interesting application of magnetism in practical construction work which is chronicled by a contemporary, is the application of electric motor drilling machines for drilling holes in the shell and deck plating of ships. These drills are mounted upon electro-magnets which receive their current from the same source of supply as the motors for revolving the drills. The object of the magnet is to hold the drill up to its work without the necessity of using a staging or temporary support for the tool. Of course the electro-magnets must be very powerful in order to secure the requisite pressure and evidently a number of experiments have had to be made before the the desired combination was secured. The magnets consist of three independent cores which form the three legs against which the machine bears upon the plates, and it has been found that this arrangement insures steadiness and satisfactory fastening of the machine. The magnetizing force is applied by a small hand switch and the motor current is controlled by a similar device. There is a wide field for a successful device of this kind in shipbuilding and the wonder is that it has not been developed in railway work, such as boiler construction where a drill which merely had to be put into place and would stick against the shell would be appreciated by those who have been obliged to erect stagings or to apply a cumbersome and awkward "old man." These applications of electricity might perhaps be considered with advantage in connection with the distribution of power in shops and the equipment of shops with air motors and other pneumatic appliances.

THE thirteenth annual report of the Kansas Board of Railroad Commissioners recently issued, is noteworthy because of the position taken by the commission in regard to many of the problems now pressing for solution in connection with railway affairs. The power of the board for good is dwelt upon and the point made that its influence is largely dependent upon the understanding by the members of the questions involved. In this connection it deprecates the constantly changing personnel of the board and states that no tribunal whose make up is so uncertain as that of a body liable to be completely changed with each recurring administration, can command the confidence that is necessary to its successful operation; and it advocates that the power of removal without cause which now exists in Kansas, shall be abrogated so that only one commissioner may be retired each year. The most serious defect in connection with the office of railroad commissioner, as it now exists, is that the choice of inexperienced men to fill the position is possible. Fully as much as in any other vocation is special training required for the proper understandidg of the subject. The science of railroading as much requires a technical education as that of any other, nor is its acquirement a matter of a few days or even months. Indeed it is not too much to assert that no man is competent to pass upon questions involved in the operation of railroads who has not devoted some years of study to the question. None will be more ready to admit the truth of this proposition than the various railroad commissioners throughout the country and, being as a class conscientious in the discharge of their duties, much of the failure to give satisfaction can be traced to their disinclination to take radical action growing out of their knowledge of their own lack of information in the case. It would be to the advantage of the country if the terms of office were extended to seven or ten years in order that the experience acquired during the earlier years of the term could be made useful during its latter part.

The entire report is well worth examination because of the candor with which the several subjects treated of therein are handled. The question of reasonable rates receives attention and indicates perhaps as well as any other, the progress made by the commission towards an understanding of the problem. The board recognizes that no fixed standard of reasonableness is possible; that what would be reasonable under one condition would be unreasonable under another; and that in any event the reasonableness of a rate is not fully determinable by the return it makes to the one who performs the service. There times when conditions demand the transportation of commodities at a loss, whereas at other times conditions justify what under ordinary circumstances would be an excessive charge. Another point made by the commission is the evident necessity for not only a uniform but an equitably relative classification. Simple uniformity is not sufficient. Many of of the present charges of unreasonableness arise out of the unjust relations maintained by present classifications, and the commission recommends that the whole matter be referred to the Interstate Commerce Commission for adjustment. The report throughout is marked by fairness and an appreciation of the difficulties attaching to the question and presents a marked contrast to the utterances of some other commissions which might be mentioned.

ELECTRIC LOCKING IN MICHIGAN.

Owing to the receipt by the engineer for the commissioner of railroads of the state of Michigan of a number of applications from different railroads to discontinue the use of the connections to distant signals worked in connection with interlocking plants and the express desire upon the part of the roads to make these signals mere signboards, the engineer, Mr. E. F. Moore, was lead to transmit a letter to the commissioner upon the subject, from which the following is taken:

The propositions involve a radical departure from what has been considered standard construction since the introduction of interlocked switch and signal systems at important highspeed crossings. The movable distant signal, as constructed and operated, is certainly liable to be more misleading than positive in indication to the engineer of an approaching train unless it is electrically locked in the tower so as to preclude the possibility of route or signals being changed until train has passed the crossing. It is conceded that there is a tendency to too high speed over interlocked crossings, also that towermen are liable to error, has been shown in a number of instances of late when, through negligence or misapprehension, they have changed the signals and opened the derail switch after engine has passed the distant signal, causing damage and delay, but happily no loss of life or limb.

I am of the opinion that on all heavy traffic and high speed lines at important interlocked crossings, the distant signals should be operated and electrically locked as stated above, believing this to be perfect and safe signaling under all conditions or rates of speed.

As distant signals may be run by when set in any position, and are therefore simply a marker showing distance from derailer, and as the engineer governing the speed of approaching trains can have no knowledge or control of the handling of them, I take the position that it will be best for the interests of both railroad companies and trainmen to place all distant signals in a fixed position of caution, unless electrically locked, and that practice in this regard should be uniform at all crossings, as varying conditions in so important a matter as signaling are not conducive to safety.

The letter is not perfectly clear in regard to what is meant by electric locking in this case. What would it avail to electrically lock the distant signal? This is a mistake often made and one which in such a case as this might lead to troublesome complications. There is no possible object in locking a signal in its clear position, but rather a very great danger might result from the inability of levermen to place a signal in the danger position, in case they should desire to do on account of a suddenly imposed obstruction upon the track. What is undoubtedly meant is a recommendation of the electric locking of the derails and the other switches in the route to prevent a collision which might occur if signals were taken away from a train and another route given. The office of electric locking, as now used in connection with interlocking plants, is to prevent the changing of a route, after the signals have been cleared therefor, until the combination is unlocked by the train. The signals, however, must not be prevented from being returned to danger at any time, should an obstruction on the track require the stopping of a train. Mr. Moore's idea is undoubtedly correct in view of present conditions if he means to recommend the locking of the switches as is assumed.

INCREASING SCARCITY OF SKILLED MACHINISTS.

Complaints are heard on all sides of an apparently increasing scarcity of skilled machinists, and while there are many reasons suggested as to why this is so, the most prominent seems to be that the field for metal workers has been rapidly widening within the past few years on account of the large increase in the use of metal in building construction and in nearly every line of industry, and the supply of apprentices is insufficient. The trouble seems to be that there are very few all-around men, and a large proportion, instead of thoroughly learning the trade, have taken up one branch to the exclusion of others in a manner entirely at variance with what used to be considered the proper way to learn this business. A large employer of this class of artisans recently stated that it was not a question of wages with him, but that he could not find a sufficient number of thoroughly trained machinists to meet his requirements. The trouble is this case seems to be that the men are not to be called unskilled, nor did they lack intelligence, but they were trained in one particular line only, which did not fit them especially for the all-around work which a machinist is called upon to do. This is a result of the application of the principle of division of labor, and there would seem to be no other result to be expected from existing conditions. This principle operates very well in cheapening and improving processes of manufacture, but it seriously interferes with a man's general usefulness when called upon to do work out of the line of that specialty in which he receives his training. The only way out of the difficulty seems to be to offer all possible encouragement to young men to enter apprenticeship which would fit them the better for afterwards taking up special branches, and also enable them to turn their hands to any of the great variety of lines of work, in case they should happen to be unsuccessful in obtaining employment in the particular branch in which they had spent the most time and were perhaps the most efficient. Therefore anything which tends to a return of the apprentice system to favor is to be welcomed as a means of improvement of the situation both as regards employers and employed.

At present there is a great temptation offered to men to take up some specialty in machine work not requiring a general apprentice training and in which the compensation is much higher at the start than one is able to earn when learning a trade. The general training, however, unquestionably make it possible for men to earn more in the long run than they can do without it, and it would seem advisable

to urge the importance of spending the time necessary to secure what might be termed a liberal education in machine work. It is unfortunate that such statements as the following can be made truthfully: "Apprenticeship is a back number and a lost art except in small country towns." "I hardly know where you will find apprentices to-day." These remarks were made by well known men at the Detroit meeting of the American Society of Mechanical Engineers last year and also the following: "The term skilled workman is now a very indefinite one. He may be a skilled workman on a slotting machine, a shaper or a milling machine, but the true skilled workman, whom you could send anywhere to do anything and who could accomplish it with few or no tools, is sadly wanting." It is a fact that men who have learned the trade thoroughly do not get out of work, and the fact that they are welcomed in all shops would seem to constitute an excellent argument in favor of encouraging the extension of apprentice systems such as are in operation in shops like those of Brown & Sharpe and Pratt & Whitney, which are quoted as high examples of the value of the system to manufacturers as well as to the men.

ECONOMY IN TIMBER TRESTLES.

The paper upon economical designing of timber trestle bridges, which appears elsewhere in this issue, was submitted to two engineers for criticism, before publication in the bulletin of the forestry division of the department of agriculture in which it appeared. The chief points in the criticism by Mr. Lindenthal were given in connection with the paper, and in addition to those a number of excellent points were brought out by Mr. Walter A. Berg, principal assistant engineer of the Lehigh Valley Railroad, which occupy so much space in the bulletin as to prevent presentation entire. Mr. Berg agrees with Mr. Johnson that a more regular and uniform practice in trestle construction should be used, which should have a foundation upon scientific research instead of the present chaotic conditions. He offers high tribute to the work of the division, but does not entirely agree with the recommendation of using smaller sizes of timber in the construction of trestles which are recommended on account of excess of strength of many of the parts as now employed. For instance, Mr. Berg does not think it proper to conclude that the prevailing practice of trestle construction has as low a factor of safety as that placed by Mr. Johnson. The bearing surfaces at the end of stringers and of caps are believed to be too small, and the trouble experienced with the present designs is that the timber indents and destroys some of the fibers, which results in speedy decay; also the recommendation of using corbels is not concurred in, and the points presented by Mr, Johnson in favor of these members do not convince Mr. Berg that their employment is desirable.

The corbels suggested are criticised because they are of the same width as the stringers. and therefore do not increase the bearing surface. However, Mr. Berg does not take into account the fact that the corbel shown by Mr. Johnson is of oak, and therefore is less likely to be damaged by the heavy pressure than the stringers themselves would be. Mr. Berg prefers the eight and one-quarter inch stringer resting on a twelve inch cap, giving ninety-nine square inches of area, to the seven and three-quarter inch corbel, resting on a nine inch cap, giving seventy square inches of bearing surface on the cap, which is the suggestion of Mr. Johnson. Corbels are considered objectionable on account of the additional cost without what he thinks commensurate improvement in the design. The use of corbels is, however, preferred by Mr. Berg when employed in the elevation of rails on curves, but as a steady every day practice he does not consider them desirable, especially as recommended by the author of the paper on account of the decrease in the actual bearing value of the cap.

Mr. Johnson makes out quite a saving effected by the use of smaller sized sticks for posts and believes that nine by nine pieces are ample for the purpose in place of the twelve by twelve timbers now in common use. This is thought by Mr. Berg to apply correctly, perhaps, to short posts twelve feet high or so, but he calls attention to the fact that the theoretical section would approach nearer to the size in common use as the length increases, and the comparatively low trestle selected by the author of the paper is not considered fair. There are many good reasons why it would be better to use a larger size in a good many kinds of trestles in which the standard size is an important item while the twelve by twelve are unnecessarily large in some cases. The question brought up by emergency repair work is sometimes of far greater importance than that of the saving of a little timber. For instance, in sending out material for emergency repairs it will be impossible to tell before hand to what use the different sticks will be put, hence sticks of emergency material can be used to better advantage if they are twelve by twelve than if they are nine by nine, and it is a question whether, as Mr. Berg points out, it is not sufficiently desirable to have a large excess of strength in trestles, on account of the probability that at some time in the life of the members conditions may cause the structure to settle or some member to fail whereby loads are brought upon the other members which they are not expected or designed to sustain.

It is interesting to note that Mr. L. F. Loree, in his recent paper upon emergencies in railroad work presented in the "Bulletin of the University of Wisconsin," gives a list of emergency material which will complete about two hundred and eight feet of frame trestle with bents at fourteen feet centers and averaging twenty feet high. This material constituted five car loads of lumber all of it being twelve by twelve and two by twelve inch material. This list was made up after the experience in emergency trestle construction, which is perhaps the widest ever had, as it was compiled after the building of the remarkable trestles at and near Johnstown after the flood of 1889. It does not necessarily follow, however, that because emergency material can be used to better advantage if furnished in this size, that the excess of lumber used in present current practice is justified in all cases, and while practical men will without doubt be put to some inconvenience if what are now called odd sizes are employed, yet there seems to be excellent ground for the position taken by Mr. Johnson, that the growing scarcity of timber requires a greater economy in the use of this material.

It would seem that perhaps a happy medium between the size recommended in the paper referred to and the larger sizes which are now in general use, could be employed to advantage without decreasing the size of the sticks to such a point as to be dangerous, and yet to reduce them enough to make a very material saving in the use of timber. The two thousand miles of timber trestles now in use on the railroads of this country, referred to by Mr. Fernow, are in a fair way to become very much less in the near future. as we are told that in different states from thirteen to nineteen thousand linear feet of trestle are being filled in with earth annually.

STEAM PIPE COVERINGS.

Our issue this week contains a description of some interesting pipe covering tests, and is published because the method of comparing the materials is thought to be new to many readers. This work formed a part of a series of interesting investigations carried out for the Boston Manufacturers' Mutual Fire Insurance Company, which has been interested for a number of years in making improvements in the use of machine lubricants and the lagging for steam pipes, boilers and cylinders on account of numerous fire losses which have been traced to defective coverings and poor lubrication. This insurance organization has carried on the work in a disinterested way which should give weight to its opinions wherever they go. For instance, the insurance company offers the use of this apparatus, which is arranged upon a permanent basis for the testing of any pipe coverings which any member of the company desires to present. The company has for a long time offered to test fire hose and oils, both those used for lubrication and for burning, and the valuable deductions made from the earlier tests are evidently to have counterparts in this new work.

Among the interesting deductions which have been drawn from the experiments those comparing different forms of well known non-conducting pipe coverings are the most striking. These show that sufficient attention has not been paid to the fire hazards resulting from the use of wooden laggings on pipes and cylinders. It has been shown that wooden laggings upon cylinders which to all outward appearances are perfectly safe and in good condition, might be so charred upon the interior and brought to such a condition that a sudden puncture whereby air would be brought into contact with the wood might result in fire. In a circular recently issued by this company is some exceedingly interesting information with regard to tests upon wooden pipe coverings which, though not suspected to be dangerous, were found carbonized throughout their entire length in a manner which, while exceedingly dangerous, was also an indication of the serious deterioration of the covering as a protection from radiation. As to the comparison of different kinds of protecting materials, it was clearly brought out that while asbestos fibre has very great merit as an incombustible pipe covering on account of the freedom from risk of fire, the efficiency of a covering as a retardent of heat will be in inverse proportion to the quantity of asbestos employed. On the other hand, the statement is made that the greater the proportion of magnesia, or the greater the number of cells of entrapped air, and the larger the proportiou of magnesia or air to the asbestos, the more effective will be the surface in preventing the escape of heat.

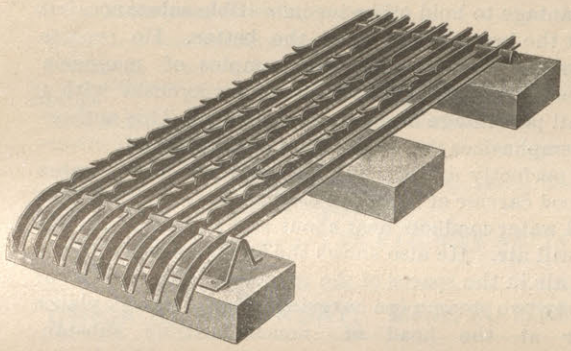
Prof. Ordway, in reporting on some experiments made a number of years ago, says that asbestos is really one of the poorest non-conductors and that by reason of its fibrous character it may be used with advantage to hold other incombustible substances but that the less asbestos used the better. He reports excellent results with two samples of magnesia covering consisting of carbonate of magnesia with a small percentage of good asbestos fibre. This authority emphasizes the importance of keeping any covering perfectly dry and and says that not only is water a good carrier of heat, but that it has been found that still water conducts heat about eight times as rapidly as still air. He also shows the importance of entraping air in the spaces of the covering. Out of a list of thirty-two steam pipe coverings Prof. Ordway places four at the head of noncombustible substances all of which are formed with magnesia, in the following order: Magnesia, loose calcined, compressed calcined, light carbonate and compressed carbonate, which is pretty good evidence of the value of this material. There are several, in fact nine, nonconducting substances which do not possess the valuable feature of noncombustibility but which will stop the loss of heat to a greater extent than magnesia, but the earlier tests, when judged from a practical standpoint, agree practically with those quoted last week. These results corroborate those made by Mr. John A. Laird in the tests upon nonconducting pipe coverings in the selection of the material to be used for this purpose at the "Chain of Rocks" pumping station of the St. Louis water works in which plastic magnesia heads the list with sectional magnesia second. This is followed by asbestos in different forms, a list of which was given in the RAILWAY REVIEW of April 13, 1895, page 202.

A careful study of these experiments would unquestionably lead to a decided distrust of wood in any form as a pipe covering and further than this it may be said that it is exceedingly dangerous to, allow wood to come into contact with steam pipes even if the temperature thereof does not exceed two hundred and twelve degrees. Many theories have been advanced for the explanation of how fires originate from steam pipes and the remarkable thing about such casualities is that the fires generally start start in the night after the pipes have cooled down. Mr. Atkinson has shown that a wooden tub in which liquids have been boiled at atmospheric pressure may become badly charred upon the outside, but in the case which he refers to the tub was pierced with a number of small nails which may have had some influence in the matter. Many persons who ought to know better have scouted the idea of wood in finely carbonized condition catching fire except upon the application of a spark or flame from an outside source. The fact is, however, well known that contact with fresh air will act the part of a spark very nicely under certain conditions. Mr. Atkinson recently performed an interesting experiment in this connection by placing a slab of vulcanized wood pulp for about an hour in an oven heated to four hundred degrees Fahrenheit. Upon opening the oven the wood pulp was found to have turned to a dense black and to have been converted into porous charcoal. The oxygen in the oven had probably been exhausted and in less than a minute after the fresh air was let in the carbonized wood took fire spontaneously. The temperature used in this case would correspond to a steam pressure of two hundred twenty-five pounds per square inch. The probable explanation of this and similar spontaneous combustion caused by steam pipes, is that the heat after charring the wood also drives the oxygen out of it, and being in a very porous condition it takes up oxygen very rapidly from the air, which causes the fire. It must not be understood that the above statements are intended to effect the interests of those engaged in the manufacture of covering materials but merely to bring out in these tests some facts which seem especially interesting.

A model of a railway bridge of 100 ft. span, built to one-fourth scale throughout, has been recently added to the equipment of the Purdue University laboratories. The model is 3 ft. 7½ ins. c. to c. of trusses and 6 ft. in hight. There are five panels in the truss. The model was designed by Mr. C. B. Peterson, a member of the faculty and was built entirely in the University shops.

BUSH COMMON SENSE CATTLE GUARD NO. 2.

The Bush Cattle Guard Co. of Kalamazoo, Mich., is putting on the market this year for the first time the cattle guard illustrated herewith. The construction of this guard is the same as that of the "common sense guard" which has been sold by this company for many years past, but the longitudinal members instead of being plain are sheared, so as to have a succession of sharp curved points which will catch the foot of an animal should it attempt to go over in one direction, but would not be severe in their action should it attempt to go in the direction in which the



points extend. The guards are put in with the points extending toward the highway, so it is practically impossible for an animal to cross to the right of way, but should an animal be on the right of way and attempt to cross to the highway it can do so without being severely punished. It is claimed that this is particularly adapted for turning small stock, such as hogs and sheep.

It will be noted from the illustration that there is not a bolt, rivet or nut in the guard. Its weight complete is 400 lbs., the length is 9 ft., the width in position 10 ft., the distance between the slats is 2 in., and it is claimed that it is the most effective stock turner in the market.

BALTIMORE & OHIO ELECTRIC LOCOMOTIVE.

[By one of those accidents which are apparently non-preventable the conclusion of the article bearing the title given above was left out of our last week's issue. Fortunately the point of division was such as to not materially detract from its value as a "continued" article, although it was not so intended.—[ED.

When it comes to a comparison of the economy of electric and steam locomotives it is readily seen that it is a difficult undertaking, knowing the figures of only a single insolated electric plant operating under special conditions and for a comparatively short time. One great incidental advantage of electric locomotives in tunnel service is that they are smokeless. This is an important consideration, but one which can hardly be computed in dollars and cents. But it may be of general interest to know how the actual operating expenses per engine mile of the electric locomotives during October, 1895, compare with those of a prominent and large Eastern railway for the same month.

For the operation of the Baltimore & Ohio Tunnel power house for the month of October, 1895, the itemized expenses were as follows:

Labor	$1,345.70
Coal ($1.35 per ton)	400.96
Oil and waste	151.26
Water	50.66
Maintenance	25.42
Total	$1,974.00

The expense on electrical locomotives was.

Motor engineers	$200,000
Oil and waste	12.16
Total	$212.16
Total expenses	2186.16

There were hauled through the tunnel 353 trains.

Average weight of train	1,095 tons
Average time of trip	20 minutes
Average current	.986 amperes
Distance of trip	4 m les
Total engine travel	1,412 miles
Total engine travel "idle"	3,756 miles
Actual time consumed for above service	118 hours
Idle time for month	626 hours

It is customary to consider an engine with steam up as equivalent to six engine miles for each hour it is idle, so that, for comparison, the actual mileage made by the engines must be increased $6 \times 626 = 3756$ miles.

The large charge of labor at power house will be the same for one, two or three locomotives in service. The items, coal, water and maintenance, and the expense on locomotives, increase with the number of locomotives in service. If this increase is assumed to be proportional, the total expense and cost per engine mile are as follows:

	Total cost.	Engine miles.	cost per engine mile.
For one locomotive	$2,186.16	5 168	$.423
For two locomotives	2,875.36	10,336	.278
For three locomotives	3,564,56	15,504	.23

The steam railroad records referred to above are for October, 1895, and may be briefly abstracted as follows:

STEAM LOCOMOTIVE SERVICE.

	East Div.	West Div.	Central Div.	N. & W Div.	Entire Line.
Locomotives in service	74	57	33	28	192
Average engine mileage in service	2834	2966	2293	2305	2703
Average cost per engine mile.					
Passenger engines	.1926	.1666	.1629	.1552	.1765
Freight engines	.2472	.2656	.3428	.2303	.2615
Switching engines	.1489	.1659	.1828	.1425	.1577
Work engines	.2391	.2258	.2617	.2169	.2354
Total engines	.2084	.2193	.2121	.1797	.2095

From the figures given above it is seen that the actual operating expenses of the electric locomotives for that particular month are about the same as for the freight locomotives on the steam railroad, i. e., 23 cents per engine mile. The service of the electric locomotives at that time was only about one-third that which it is expected they will have to do when the passenger service is taken up and the line extended the full distance.

As originally intended, a method of using to advantage the power of the station while the electric locomotives are idle is soon to be incorporated in the plant. Under the new conditions the cost per engine mile for the electric locomotives will be far under that of steam.

A comparison of the efficiencies of steam and electric locomotives shows slightly in favor of the electric. Observations made on French railways and on the Pennsylvania Railroad show that about 45 per cent to 55 per cent only of the indicated horse power of steam locomotives is applied to hauling trains. The efficiency of the Baltimore & Ohio plant is in the vicinity of 60 per cent to 65 per cent under normal conditions.

A word may be added as to our experience with the overhead conductor system. The conductor in the tunnel has now been in position for nine months. During all of this time coke burning locomotives have been used, for passenger service with the consequent presence of a good deal of gas and vapor. For the first six months about half of the conductor was constantly wet from the drip due to leaks in the masonry. This occasioned a muddy, slimy deposit over the insulators and a considerable portion of the conductor. The porcelain insulators are almost entirely obscured in some places by this deposit and that of small particles of carbon given off by the locomotives.

Current was first turned on the line about three months after the tunnel structure was erected. The leak to earth was at first 21 amperes, but, in a day or two, this dropped to about four amperes—the present leakage. The inside of the conductor was coated with a combined deposit of rust and muddy sediment. Heavy currents were taken from it by the contact shoe only with difficulty and the presence of much arcing, heating and showers of sparks. It was found impracticable to run on this surface. By applications of kerosene and frequent scraping with special shoes, a direct contact of the trolley shoe with the conductor was made possible. Although a single contact shoe then worked with little or no sparking, two shoes in tandem were adopted. Their operation though the conductor is smoother, and the contact over muddy portions of it is more positive.

At intervals of about three weeks the conductor is treated with kerosene, and brushing shoes are run through it, about one or two trips with these brushing shoes being all that is necessary. This serves to prevent the further accumulation of rust and to remove the sediment from the contact surfaces. An inspection shows a smooth surface over which the shoes run. Contact with the metal is seen to be in high spots and thin lines which are slowly increasing in extent.

No considerable sparking now occurs, except at the wet places, where it is occasioned by the presence of water and sediment. With the exception of three places, about 200 ft. long, each, the conductor is at present dry.

The bolts to the arch of the tunnel are both galvanizen and painted. They show no signs of rusting. The painting has, in general, protected the surfaces of the conductor and channels. The sides and top of the inside of the conductor are coated with rust. Most of this is hard and close grained, some of it, however, flaky. In no case is there apparent a reduction of thickness of any of the ironwork, due to rusting. Outside the tunnels the conductor is in uniformly good condition. It adapts itself to changes of temperature without trouble. The inside of the conductor is coated with rust, but in no case has there been any trouble from it. The deposit appears to be very light. There was at no time any sparking between cotact shoes and conductor outside of the tunnel.

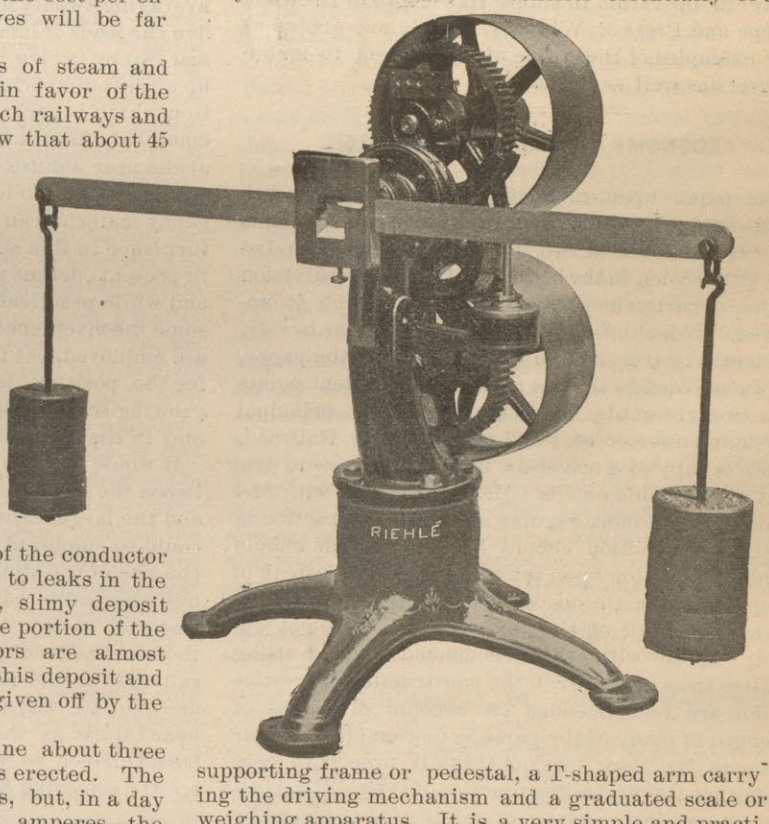
THE RAILWAY SIGNALING CLUB.

The regular March meeting of the Railway Signaling Club was held at the Great Northern hotel, Chicago, on the evening of March 10. The discussion of the evening was upon the report of the committee on "Colors of Lights for Night Signaling".

The report was published in full in the RAILWAY REVIEW of last week and an account of the discussion will be given in a subsequent issue. The report was received with interest and in the discussion the impression was given that the committee was believed to be right in its prediction as to the possibility of changing from the present system, but it was thought that the club should not endorse any system except that which is considered the safest which can be suggested. No action will be taken in the line of sending out a recommendation by the club in regard to lights until the wishes of all the members in regard thereto are ascertained by letter ballot. At this meeting the report of the committee on "Interlcoking Rules" was received and discussion thereof deferred until the next meeting which will be held May 12.

RIEHLE-ROBINSON 25 H. P. TRANSMISSION DYNAMOMETER.

The accompanying illustration shows an improvement in the original dynamometer designed and built by Prof. S. W. Robinson, of the Ohio State University, for the mechanical engineering testing laboratory of that institution, and consists essentially of a



supporting frame or pedestal, a T-shaped arm carrying the driving mechanism and a graduated scale or weighing apparatus. It is a very simple and practical form of dynamometer, and is said to possess great accuracy. It is especially adapted to commercial use, being light for transportation, quick in adaptation, easy to read and the results such as can be rapidly converted into horse power transmitted by an engine or electro-motor, or the amount of power consumed in driving a single machine or machinery plant.

The instrument is so designed that the pulleys overhang and can be swung around to any desired position, which makes it convenient to put either belt on or off without unlacing, and to tighten or loosen both belts simultaneously. It is fitted with roller bearings throughout and is furnished with a revolution counter, a dash-pot and standard weights.

The dimensions are as follows: Extreme hight, 3 ft. 9 in.; extreme length, 4 ft. 4½ in.; extreme width, 2 ft. 1½ in.; weight, 550 lbs.; shipping weight, 700 lbs.

ARCH AND VAULT TESTS OF THE AUSTRIAN SOCIETY OF ENGINEERS AND ARCHITECTS.*

During the years 1891 and 1892 the Austrian Society of Engineers and Architects conducted a series of tests on brick and concrete arches and vaults that were in every way much more complete than any hitherto attempted. The results obtained have attracted much attention from engineers and architects, although the arches tested are not in general use in this country.

Some idea of the scale on which these tests were conducted may be gained from the statement of the contributions of money, material and labor from government departments, railroads, manufacturing companies and private concerns, the total contributions from these sources amounting to $19,800.

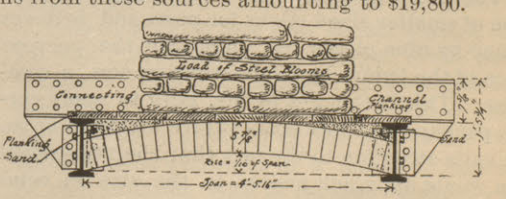


FIG. 1.—SECTION OF BRICK ARCH.

The report covers (1) tests of eighteen floor arches, representing eight different types of floor construction; (2) tests of two culverts of 32.8 ft. span and 1 in 10 rise; (3) tests of four bridges of 75 ft. span and 1 in 5 rise; (4) an exhaustive series of tests to determine

*Translation of a report of a committee to the society. Published by Architecture and Building from which journal this reprint is taken.

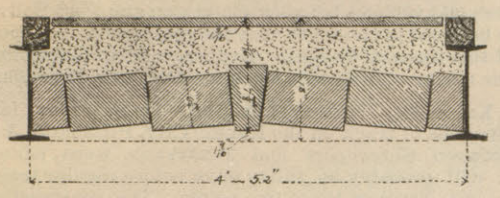


FIG. 2.—SCHOBER SYSTEM.

the strength and elasticity of all materials used in the above arches; (5) a theoretical calculation based on the results attained; (6) conclusion from the results in regard to theory and construction.

The object of the society in reprinting the report for general circulation is to bring about desired improvements.

Of the various tests made those on the flat arches for floor construction will probably prove of the most

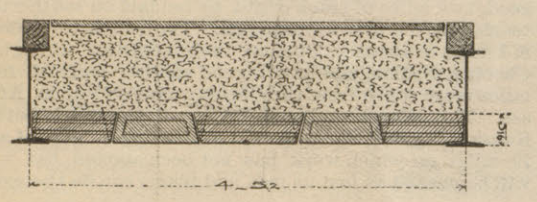


FIG. 3.—HONEL SYSTEM.

interest. These tests include four arches of ordinary brick, five of flat tiles (differing entirely from those used in this country), three of concrete, three according to the Monier system, two of corrugated iron and one arch constructed according to the Melan system.

The above tests were divided into three series: A, seven arches with a span of 4 ft. 5.16 in.; B, seven arches with a span of 8 ft. 10.2 in.; C, four arches having a span of 13 ft. 3.6 in.

The arches in the first and second series were built between I beams, which were rigidly secured

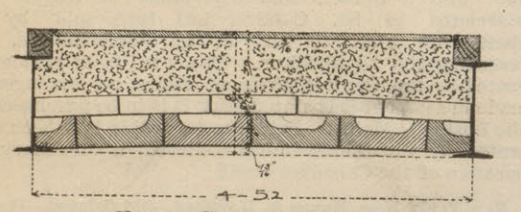


FIG. 4.—GLUCKSELIG SYSTEM.

and supported, so that no possible movement could take place. The third series were built between solid masonry abutments, as shown in Fig. 6.

The latter series of arches were regarded as a connecting link between floor arches of small span and those of highway bridges, and the tests were instituted principally for making a comparison between arches of concrete, those of the Monier system and of brick work. The tests of the flat arch systems were for spans of 4 ft. 5.2 in. only, as these arches are not designed for much greater spans.

The construction of these arches is shown in Figs. 2 to 5.

Of the seven arches in the short span series two

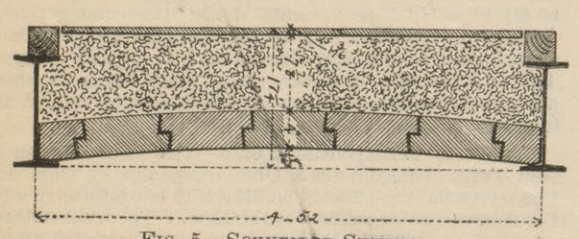


FIG. 5.—SCHNEIDER SYSTEM.

were of brick (one header, one stretcher), one of concrete and one of each of the systems shown in Figs. 2–5.

Of the ways of laying the bricks—headers or stretchers—the latter in every case showed a superiority, probably on account of the lesser number of joints.

The concrete arch, which was only $2\frac{15}{16}$ in. thick, with a rise of $4\frac{1}{2}$ in., was composed of one part Portland cement and five parts sand, and sustained 1,638 lbs. per square foot without failure or cracking. The deflections of concrete were about an average of the two brick arches, hence this arch may be considered as equal in strength to a brick arch $5\frac{3}{4}$ in. thick, while it has the advantage of lesser weight.

The four flat arches showed an unexpectedly high carrying capacity.

The Schober arch (Fig. 2) and the Honel arch (Fig. 3) gave evidence of a very small deflection, even less than that of the brick arches, and a load of 1,638 lbs. per square foot caused them to undergo very little change.

The Gluckselig arch (Fig. 4) failed under 1,638 lbs. per square foot, and the Schneider arch (Fig. 5) under 1,651 lbs. per square foot, both arches showing considerable deflection beforehand.

It may therefore be concluded that these arches are completely safe for all practical purposes, provided the skewback beams are not placed too far apart and the workmanship is first-class.

When using either of these systems, however, one must not be too economical in the use of tie-rods, to prevent any lateral deflection of the floor beams.

All of the above arches were tested by loading with iron and steel blooms. To get as uniform a load as possible a layer of cinders, etc., was evenly distributed over the arch and a planking composed of floor boards was placed thereon. The load was applied over the whole surface, and the arch had at least four months to set before testing.

Second Series.—This series consisted of one concrete arch $3\frac{3}{4}$ in. thick, one arch of ordinary bricks, one arch of Honel's bricks, two Monier arches (one leveled up with cinders, the other with concrete), and two arches of corrugated iron, one with the edges reinforced and the other without reinforcements.

All were sprung between I-beams placed 8 ft. 10.2 in. apart between the webs.

Each of these arches was loaded over one-half of the arch only, although the arches were leveled up and the planking laid over the whole surface as in the first series.

The arch composed of ordinary bricks gave evidence of but little change under a load of 410 lbs. per square foot, and carried 885 lbs. per square foot before it failed. This arch was $5\frac{5}{16}$ in. thick, composed of a single course of brick, and had a rise of 9.85 in.

To see if a thinner arch would answer the same purpose, one arch was constructed of Honel's bricks, which were only $3\frac{15}{16}$ in. thick, with a rise of $5\frac{5}{16}$ in. (1 in 20). This arch, however, failed under an eccentric load of 491 lbs. per square foot, after having shown considerable deflection beforehand. It does not seem advisable, therefore, to use a 4 in. arch for so great a span.

The arch of concrete $3\frac{5}{16}$ in. thick with a rise of 1 in 10, composition 1 to 4, fulfilled all requirements, as it sustained 614.4 lbs. per square foot before it began to crack appreciably, and failed under an eccentric load of 1,130 lbs. per square foot.

The two Monier arches deflected on an average equally as much as the concrete arch, and showed no appreciable superiority.

The arch leveled up with concrete showed an increase in strength of only 8 per cent, although the superficial layer of concrete was applied immediately after the arch itself had been built.

The arches of corrugated iron deflected at the crown very much more than either the concrete or Monier arches.

The arch which had 2.3x2.3 in. angles riveted to the edges of the iron proved about 13 per cent the stronger.

Third Series.—Span of 12 ft. 3.6 in.

The brick arch, $4\frac{7}{8}$ in. thick, with a rise of $13\frac{3}{4}$ in., commenced to crack under an eccentric load of 137.5 lbs. per square foot, showing that it was much too weak for the purpose.

The concrete arch, $3\frac{15}{16}$ in. thick, with a rise of $15\frac{7}{8}$ in. failed under an eccentric load of 812 lbs. per square foot.

The Monier arch, 2 in. thick, with a rise of $15\frac{1}{2}$ in. failed under an eccentric load of 895 lbs. per square foot. The deflections of this arch were somewhat greater than those of the concrete arch.

After the above arches had been tested a new system appeared, the Melan patent, and an arch of this type being constructed by the manufacturers, it was tested in 1893 by the same committee.

This arch, which had a span of 13 ft. 11 in. and a rise of 11.4 in., was constructed of curved ribs of $3\frac{1}{2}$

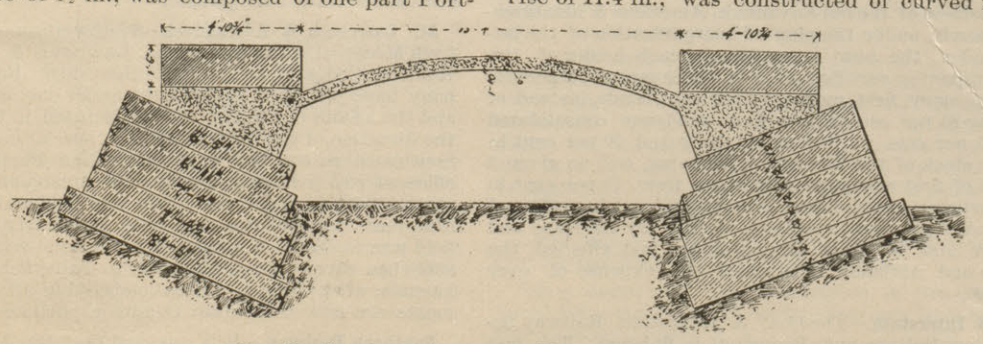


FIG. 6.—CONCRETE ARCH WITH MASONRY ABUTMENT.

in. I beams, spaced 3 ft. 3 in. apart, with 1 to 5 concrete rammed in between. The thickness of the arch was the same as that of the I beams, $3\frac{1}{2}$ in. On account of lack of material the loading of this arch was interrupted after 1,412 lbs. per square foot, over one-half of the arch, had been imposed. The permanent changes discovered after the removal of this load were very slight.

The report states: "From the behavior of this construction there is no doubt that these vaults have a far superior carrying capacity than either the plain concrete or the Monier arch."

Aside from the great strength displayed by the Melan arch, which may be considered as a direct outcome of these tests, the most important fact developed is the superiority of the plain concrete arch, from a commercial point of view over the Monier arch.

The ordinary Monier arch consists of wire netting imbedded in the concrete. The concrete must not be coarser than 1 to 3, which makes this system much more expensive than the plain concrete arch.

Referring to the two types of arches, the report says: "Compared with a plain concrete arch, a concrete arch with one wire netting has shown but little carrying capacity, so that the difference can not have any importance to the ordinary building practice."

Engineers have for a long time recommended Monier arches with two wire nettings for large spans, but it is nearly impossible to use two nettings in a small span.

In making all of the tests careful measurements were made of the deflection under different stages of loading, and these are given in the tables contained in the report.

PATENTS ON RAILWAY APPLIANCES.

[The following list of patents granted for inventions relative to railroad appliances for the week ending March 17, is reported especially for the Railway Review, by Chas. L. Sturtevant, patent attorney, Washington, D. C., from whom printed copies can be obtained for 15 cents each.]

Adams, Thos. E., Cleveland, O., electric locomotive, 556,654.

Bassett, Norman C., Lynn, Mass., assignor to General Electric Co., of New York, motor suspension, 566,488.

Clarkson, Eugene C., Cleveland, O., car dumping machinery, 556,458.

Edey, Alfred S., Des Moines, Ia., car coupling, 556,406.

Grace, Claude M., assignor of one-half to A. E. Bragg, Philadelphia, Pa., block signal telegraph, 556,670.

Harris, Alex. B. B., Bristol, Tenn., railway tie plate, 556,602.

Lewis, Howell N., Green Cove Springs, Fla., drift bolt or railway track spike drawer, 556,499.

McClellan, Virgil, Lawson, and G. D. Warren, Villa Park, Colo., railway frog, 556,685.

O'Toole, Richard, Thurmont, Md., railway crossing signal, 556,553.

Osborn, Byron E., Auburn, N. Y., electric railway system, 556,516.

Rasch, Peter, Cleveland, O., apparatus for hoisting and unloading railway cars, 556,371.

Roberts, Thomas B., Kansas City, Kan., refrigerator car, 556,374.

Westinghouse, George, Jr., Pittsburgh, Pa., underground conductor for electric railway, 556,602.

NOTICES OF PUBLICATIONS.

The Bush Cattle Guard Co. of Kalamazoo, Mich., has issued its fifth annual catalog, which bears the date of 1896. The greater part of the pamphlet is given to a description of cattle guards, and the introduction contains the statement that over 16,000 guards manufactured by this company have been placed in service. It is also stated that 2,400 guards are in use on one road. There are many interesting items, among which is a long list of court decisions relating to the use and maintenance of cattle guards. The illustrations are all good and clear and the descriptions complete and comprehensive. The printing and paper are excellent in quality, and the only criticism we have to offer is that the pamphlet is not made to standard dimensions. The "easy car pusher" is well illustrated and described, and some very strong letters in recommendation are reproduced.

The Rand & McNally Atlas for 1896 is still another improvement on all that have preceded it. Not only are the number of pages increased, there being 398 in the present issue, but there are also maps of the principal cities of the United States giving all points of interest and the names of all streets in the business portion of each. One of the great advantages of the work is the method of numbering railroads, rendering it an easy matter to trace each road however intricate the net-work is at junction points. It names and locates each post office, and in case the town is not on a mail roule, the place at which its mail is received is indicated. Among other things the atlas tells what railroad a town is on, by what express company to ship, which towns are money order stations, which are telegraph stations, when a town is a county seat, the population of counties, cities and towns; it gives the names of rivers, mountains and lakes, and is in all ways a valuable adjunct in any business and indispensable for some. It is well bound in heavy board covered with canvas, and presents a neat appearance. As is usual the paper and press work is of the best, and its accuracy may be relied on. The New York address of the Rand & McNally Co. is 61 East Ninth street, and the Chicago, 160-174 Adams street.

PERSONAL.

Mr. C.W. Melville has been appointed traveling passenger agent of the St. Louis & San Francisco at St. Louis.

Mr. W. C. Gerberich has been appointed traveling passenger agent of the Burlington, Cedar Rapids & Northern, vice E. J. McDole, resigned.

Mr. W. H. Applegate has been appointed agent of the Nickel Plate line, with headquarters at Cincinnati. He will have the Cincinnati and Louisville territory.

Mr. O. A. Constans has been appointed division freight agent of the Baltimore & Ohio, with office in Pittsburgh.

Mr. Constans is an experienced railroad man, and has many friends in that city.

Mr. R. W. Wallace, traveling passenger agent of the Erie, has been temporarily assigned to the position of general agent at Cleveland, made vacant by the death of Mr. L. Fouts, noted lact week.

Mr. J. P. Gay, of Detroit, has been appointed manager of the Michigan & Milwaukee fast freight line. It is said that he will also be made assistant freight agent in charge of the Grand Haven division of the road.

Mr. Theodore Kline, formerly of the Mexican National Railway, will, on May 1, take the position of general manager of the Inter-Oceanic Railway, and Acting General Manager Stewart will retire with an excellent record and accept a place on the board.

The appointment of Mr. A. P. Bigelow, as general western freight agent of the Baltimore & Ohio with headquarters at Chicago has been announced, as has also that of Mr. James Mosher to be general eastern freight agent of the same road with headquarters at New York.

Another change has been made in the staff of officers of the Grand Trunk in Canada, Mr. John Earles, western district freight agent at Hamilton, retiring from the service. Mr. Earles will be succeeded by Mr. Robert Quinn, now the European traffic agent at Liverpool, who will shortly come over to this country.

Owing to the serious illness of Vice President and General Manager T. B. Burnett, of the Los Angeles Terminal Railway, that company announces the following elections and appointments: Mr. T. E. Gibbon, vice president; Mr. William Wincup, acting general manager, and Mr. F. K. Rute, treasurer and auditor.

Mr. Randolph Clark, assistant engineer of the Grand Trunk of Canada located at Stratford, has been relieved from further duty. Mr. Clark entered the service of the company in 1851 at Montreal, and three years ago the territory, under his charge was enlarged to take in all of the Grand Trunk line west from Port Hope and north to Midland.

At a meeting of the Chicago and Ohio River Traffic Association, held March 18, Mr. C. E. Fulton waselected secretary of the committee which the lines of the association will compose, and which will be auxiliary to the new central freight committee. He was also chosen to succeed Chairman Tucker as secretary of the Mississippi valley committee.

Announcement has been made by Vice President and General Manager Ramsey, of the Wabash, that Mr. George M. Burns has been appointed fuel agent of that company. He will have charge of the purchasing, distribution, inspection and testing of all fuel for locomotives, reporting to the vice president and general manager. His office will be in St. Louis.

Mr. Henry T. Gallup, formerly general superintendent of the Boston & Albany Railroad, died suddenly at his home on Orr's Island, Casco Bay, where he had resided three years. He was about 60 years of age. Mr. Gallup entered railway service in 1853 as a brakeman on the Boston & Albany road, becoming in 1881, assistant general freight agent. From 1885 to 1886 he held the position of general freight agent, when he was made general superintendent. His entire railway service was with the Boston & Albany road.

Mr. J. H. St ewart, of Cleveland, O., well known in rai road circles throughout the country,was found dead in bed l in his residence there one morning this week, having been asphixiated by gas, which in some unaccountable manner escaped from a pipe in his room. Mr. Stewart had for many years been identified with various railway systems in responsible positions, and was one of the organizers of the Sandusky, Columbus & Hocking Railroad Company, and was president of the construction company which built that road.

Mr. Thomas W. Galleher, who for 24 years has been in the service of the Baltimore & Ohio road, has been appointed general freight agent of that road with headquarters at Pittsburgh, succeeding Mr. C. S. Wight, promoted to freight traffic manager. Mr. Galleher began railroad work at the age of fourteen years as messenger in the telegraph office. He served successively as telegraph operator, chief clerk in division freight office, traveling freight office, etc., until 1887, when he was appointed division freight agent at Pittsburgh, and has since filled that position.

At the last meeting of the freight committee of the Central Traffic Association the following resolution was passed as a tribute to C. H. McKnight, formerly chief assistant and secretary to Commissioner Blanchard of the Central Traffic Association,and who resigned some time ago to go to New York as an employe of the Joint Traffic Association: "Resolved, that we take this occasion to testify to the appreciation in which Mr. McKnight was held by the members of the freight committee, both in his official and personal relations, during the time in which he presided over the deliberations of this body, and to express our cordial wishes for his continued success in his new sphere of duty."

Mr, Harry B. Stewart was on March 16 appointed general passenger agent of the Cleveland, Canton & Southern R., vice F. R. Briggs, resigned. The appointment was effective at once, and Mr. Stewart was at his desk on the day of his appointment. He is a young man who has been in the railroad business for about 10 years. For several years he was traveling auditor of the Missouri Pacific, and since 1890 he has been the ticket agent of the Cleveland, Canton & Southern at Canton. Outside of Cleveland, Canton is the most important point on this road, and the work done there by Mr. Stewart, which was both that of ticket and passenger agent, won for him the offer of the general passenger agency, which he has accepted.

On Sunday last a number of changes in the passenger department of the Michigan Central became effective. Mr. Louis D. Heusner, city passenger agent at Chicago, has been made general western passenger agent and has been given direction of all business not only in this city, but in all the territory west to the Rocky mountains. He has been succeeded as city ticket agent by Mr. Warren Keeler. Mr. W. J. Seinwerth is western passenger agent for the states of Indiana, Illinois and a portion of Iowa and Missouri; Mr. Luther L. Canfy is Wisconsin passenger agent; Mr. Walter L. Wyan is northwestern passenger agent in charge of the states of Minnesota, North and South Dakota and Montana and the Province of Manitoba; Mr. H. H. Marley is southwestern passenger agent in charge of Kansas City, a portion of Missouri and the states of Kansas. Colorado, Nebraska, Arkansas, Texas, Oklahoma and the Indian Territory. All these will report to Mr. Heusner as general western passenger agent. The eastern agents of the road are Messrs. W. H. Underwood, Joseph S. Hall and John G. Laven, and Mr. Carlton S. Crane has charge of Pacific coast territory.

RAILWAY NEWS.

Chicago Elevated—Union Loop.—The Union Loop Co. that is to build the downtown elevated railway loop has secured the right of way on Van Buren street, notwithstanding the opposition of large property owners on that street. A two-track elevated line will be constructed on Van Buren street from Wabash avenue to Market street, and one-track extension from Market street to Halsted. Trains over the Metropolitan Elevated R. will turn east into Van Buren at Halsted, and will run directly east to a connection with the loop. Westbound trains on the Metropolitan will leave the loop at Fifth avenue and Van Buren street, run west on Van Buren to either Franklin or Market, turning north in the street which may be decided upon to a connection with the present tracks of the Metropolitan Elevated. A new company to be known as the Union Consolidated Elevated R, Co. with a capital of $1,000,000 applied for letters of incorporation on March 12, and this company will build the south line of the loop and the connection with the Metropolitan Elevated. The change in the plans is the result of the fight which has been made by the property owners in Van Buren street to the building of an elevated road in that thoroughfare. This opposition has been so strenuous it was found impossible to obtain the necessary signatures for a majority of the property in Van Buren street between Wabash and Fifth avenues as is required under the law. It is expected that the loop can be put into operation by September 1.

Chicago, Peoria & St. Louis.—It is said that Messrs. D. B. Hatch, of New York and C. E. Jackson, of Middletown, Conn., directors and members of the executive committee of the Chicago, Peoria & St. Louis have expressed themselves as satisfied with the business and prospects of the road, and believe the contemplated improvements at East St. Louis will result advantageously to the property. The physical and financial condition of the company is good, and steady progress will be made in ballasting and in such additions to the property as will promote its economical working and enable it to care for its business. It is also said that these gentlemen positively and authoritatively deny the affiliation with or sale of this road to any other company and state that the Chicago, Peoria & St. Louis is considered by its owners to be good property and able to earn its charges and leave a surplus, and that it is the settled purpose of the directors to operate the property absolutely and independently. The property is not for sale.

Cleveland, Lorain & Wheeling.—It is proposed to build a second track or loop around the Medina hills which will relieve and shorten the main line of the Cleveland, Lorain & Wheeling and greatly reduce the grades for the through lake business. This line will be about 9 miles in length. It is is also thought to build a branch 1½ miles in length into the Berea stone quarries and various extensions of sidings and coal branches. There will also be the purchase of additional equipment and improvement of car and machine shops as well as further needed improvements of the Lorain docks and machinery for the transfer of coal between cars and vessels. All these changes and improvements are among the purposes of the new $1,000,000 mortgage.

Georgia & Alabama—Central Railroad of Georgia.—President John Skelton Williams of the Georgia Alabama R. and President H. M. Comer representing the Central Railroad of Georgia, have entered into an agreement whereby the Lyons branch of the Central is secured under perpetual lease to the Georgia & Alabama. This branch extends from Meldrim, 17 miles from Savannah to Lyons the junction with the Georgia & Alabama, a distance of 58 miles. There is also a trackage agreement between the two lines for the use, by the Georgia & Alabama, of the 17 miles from Meldrim to Savannah, including the use of the extensive terminals of the Central in Savannah, on a basis similar to that enjoyed by the Florida Central & Peninsular road.This agreement which will give the Georgia & Alabama an important entrance into Savannah without having to build the 75 miles of new parallel line as first proposed, will involve a change in the proportion of new securities of the Georgia & Alabama R., to be given to the holders of the old Savannah, Americus & Montgomery R. bonds, under the plan of reorganization of the latter. Under the new arrangement, each holder of the trust companies, certificate for $1,000 Savannah,Americus & Montgomary first mortage 6 per cent bonds, instead of receiving 80 per cent in new first mortgage consolidated fives, 75 per cent in preferred stock and 50 per cent in common stock of the Georgia & Alabama, will be given 5 per cent of first mortgage preference fives, 70 per cent in first mortgage consolidated fives, 65 per cent in preferred stock and 80 per cent in common stock. By the lease and trackage and terminal arrangements just effected, the Georgia and Alabama R. is saved the expense of over $1,000,000,

Gulf & Interstate.—The Gulf & Interstate Railway between Port Bolivar and Beaumont is finished. The last spike was driven at 7:45 on the evening of March 13 at a point six miles above Port Bolivar, the construction force having loaded the material and laid nearly two miles of the track that day. Monday the officials of the road were to make a trip over the new track, which will require considerable ballasting before it will be ready for heavy traffic, and as soon as this is done and ferriage arrangements made by which Galveston can be reached, the line will be opened for business. The officials of the road will submit a ferriage proposition to the county commissioners whereby the transfer work of the railway company may be done in connection with the proposed county ferry for passengers and vehicles between Galveston and Port Bolivar. It is believed in the south that the completion and operation of this line will be quite advantageous to Galveston and the means of diverting much traffic in this direction.

Kansas City, Pittsburgh & Gulf.—On Saturday last the two ends of track on the Kansas City, Pittsburgh & Gulf, between Shreveport and Texarkana, were joined, but it will probably be thirty days before regular trains can be run between these two points. The construction department will have to surface the track and do a great deal of necessary work on bridges and trestles before it can turn the line over to the operating department for regular traffic. Of course construction trains will be run carrying material for southern extension,etc. The sidetracks are laid in the yards and shop grounds at Shreveport, and work of continuing the southern extension will be pushed as rapidly as possible. The construction gang will soon get through with the first mile of heavy grading on main line south, which will take work up to where Corrigan Bros.' work begins. Corrigan will move his camp south of Wallace lake inside of two weeks, and if the weather holds good, two miles of track ought to be laid on southern extension by the first day of April. The contractors, Monroe & Lee have about completed their contract through the Choctaw Nation, and have signed another contract for 20 miles more south from the Choctaw Nation line in Arkansas. This places under contract all the work between Kansas City and Shreveport, La., leaving a gap of about 70 miles on which work has not been started, but which will be pushed as fast as men and teams can do the work.

Marietta & North Georgia.—The Knickerbocker Trust Co. of New York has obtained an injunction against Messrs. Erb, Carmichael et al. representing the Atlanta, Knoxville & Northern Construction Co., restraining them from transferring their interests in the Marietta & North Georgia, on the ground that defendants are indebted to it for $92,500 loaned last November for the first payment of the purchase. They have also defaulted on their second payment of $153,000, which was due March 6. It is probable that the road will be sold again, and it is reported that the Louisville & Nashville will secure control.

Montreal, Portland & Boston.—This road which is 32 miles in length extending from St. Lambert on the south side of the St. Lawrence river opposite Montreal, to Farnham where connection is made with the Central Vermont, and also a branch line 8½ miles in length from Marriette to St. Cesaire, has been sold by the sheriff for $1,625 to Mr. J. M. Greenshields, representing the bondholders. The road is at present operated by the Central Vermont, under an arrangement made in 1883, but it is stated that it is to be purchased by the Boston & Maine. Previous to 1883 it had been operated by the Southeastern Railroad, a subsidiary corporation of the Canadian Pacific.

New York, New Haven & Hartford—Old Colony.—The directors of the New Haven road will met in New Haven on Saturday next and, in addition to declaring the regular 2 per cent dividend, will probably consider plans for a new union station at Kneeland street, Boston. No agreement for a new union station has as yet been signed by the individual companies, but all interests have practically agreed to a union station, including the Albany road and the city. The station will probably be built by a terminal company, which will issue bonds and stocks, the bonds to be sold to the public, while the roads interested in the station will hold the stock. Pres. C. F. Choate is quoted as saying: "I have never heard the subject of a lease of the New England road by the New Haven hinted at, outside of the newspapers, and don't believe any plans for a lease have been entertained by the New Haven management." He also states that the report that the Old Colony and the New Haven roads contemplate an expenditure of $15,000,000 in improvements during the coming two or three years is ridiculously absurd, and that the report of a stock issue by the New Haven road is equally untrue. The Old Colony, however, may issue stock in small amounts from time to time as extra money is needed for improvements, as it has in times past.

New York, Pennsylvania & Ohio.—The consolidation of New York, Pennsylvania & Ohio companies of Ohio and Pennsylvania was effected on March 16 in conformity with the reorganization scheme of the Erie. The consolidated company has $20,000,009 of stock, and will have $20,000,000 of bonds, the mortgage to be filed within a day or two. C. E. Whitehead of New York is president and John Tod, vice president.

Pittsburgh, Marion & Chicago.—This road, which is 25 miles in length, running between New Galilee, Pa., and Lisbon, Ohio, has been ordered sold to satisfy a judgment for $6,133 in favor of W. S. Gurnee, Jr. & Co., a banking firm of New York. W. S. Gurnee, of the firm securing the judgment, is one of the directors, and a majority of the directors are New York people.

St. Lawrence & Adirondack—Southwestern—Dispatches from Montreal state that the St. Lawrence & Adirondack Railway Company and the Southwestern Railway Company have just been consolidated under one management, and the affairs of the two will be operated in future under the direction of the former road. A special meeting of the Southwestern was held at the Canadian Pacific Railroad office, at which it was arranged to amalgamate. Then a special meeting of the two roads was held and the ninety-nine years' lease of the road from Beauharnais to Valley field was ratified. A proposed extension will provide a suburban service from Montreal to Valleyfield and Beauharnais, after June 1. Bills embodying all these movements are now before the Dominion parliament.

Southern Railway.—It is reported that the Alabama coa operators have effected a deal with the Southern Railway to cover the immense coal market among the Mississippi sugar plantations south of Greenville, heretofore occupied by the Pennsylvania operators. This trade has heretofore gone from Pittsburgh mostly by river and amounts annually to about 1,500,000 tons. The deal includes freight rates from Birmingham to Greenville low enough to enable Alabama to meet Pennsylvania all-water route prices, a fleet of barges to transport the coal from Greenville south, and ample tipples at Greenville, which the Southern Railway will provide.

NEW ROADS AND PROJECTS.

Alabama.—A new road about 8 miles in length which has been built by the Tallasee Falls Manufacturing Co. from Goodyn Station, Ala., on the Western Railroad of Alabama. to Tallasee, is now finished and ready for traffic. It was built for the purpose of connecting the cotton mills of the Tallasee Falls Manufacturing Co. with the Western of Alabama by which road it will probably be operated.

Arkansas.—The Sunnyside, Hamburg & Western R. Co. has filed articles of incorporation with the secretary of state in Arkansas. This road was projected in December last and a part of the preliminary surveys have been made. It will commence at a point at the Mississippi river in Chicot county running thence in a westerly direction to a point at or near Portland in Ashley county on the Missouri Pacific, thence west to Hamburg, county seat of Ashley county. The directors of the company are Austin Corbin, W. G.Bosworth, F. W. Watkins and G. S. Edgel of New York; George Drew of Sunnyside; J. C. Connerly and Walter Davies of Lake Village; J. D. Dean and R. A. Pugh of Portland. The length of the road will be 60 miles, and the capital stock is $600,000. Mr. Austin Corbin of New York is the backer of the enterprise and who will construct the line principally in the interests of his Chicot county plantation.

California.—The Yosamite Valley & Merced R. Co. has been incorporated in California. This road was projected last year and surveys were made. The directors of the new company are James B. Stetson, John D. Spreckels, O. D. Baldwin, Robert Oxnard, James Cross, A. L. Stetson and G. A Wulkop of San Francisco. The principal offices are to be located at Coulterville, and the capital stock is $1,500,000 with $90,500 subscribed.

China.—A San Francisco press dispatch contains the following: "Col. M. R. Jefferds, an American railway engineer, who has an agreement with the concessionaires by which he is to have the contract for building the Pekin & Hankow R. provided he secures subscriptions in this country or in Europe to the amount of 10,000,000 taels (about $13,500,000 in Mexican money),is in this city. There are in China at present only two short railroads, one of 150 miles and the other of 62 miles. In January Hsu Yn Tsiang, mayor of Kuang Tung, was given by Prince Kung, superintendent of military affairs, permission,under the authority of the emperor, to construct a railroad from Pekin north to Hankow, a distance of 750 miles. The right is also granted to build from Pekin south to Canton, a distance of 600 miles, upon completion of the Hankow road. One of the conditions is that not less than two-thirds of the capital necessary, which will amount to about 30,000,000 taels, must be subscribed by Chinese. Col. Jefferds, who was in China at the time, secured the agreement from Hsu Yn, and when he carries out the terms will give him the contract for building the road. He came to California to induce the Chinese merchants in San Francisco to subscribe and use their influence to dispel the prejudices of their countrymen against railroads and show them their value.

Georgia—The New York & Georgia Lumber & R. Co. is building a road southwest from Tallapoosa, Ga., toward the Chattahooche river with the intention of extending it to Roanoke, Ala., in the future, a distance of 55 miles. At present, however, only five miles of road will be built to reach pine land owned by the company. Two miles of this has been completed. There is a good deal of timber bridging on the road, and two bridges 250 ft. and 190 ft. long respectively have been built, and another 288 ft. long will be erected shortly. The company has a contract to deliver at Tallapoosa 25,000 ft. of logs daily for 6 months and 50,000 ft. daily for the next 6 months. Jesse Barlow is president and W. H. Greene secretary of the company building the road.

Illinois.—The new electric road which was to be built between Quincy and Niota is by no means an assured fact. Mr. J. C. Hubinger, of Keokuk, Ia., offered to build the road, which was to be a Santa Fe connection, provided the people of Quincy would give him $75,000 and terminal facilities. The citizens who had the Hubinger project under consideration have informed him that they are after a more direct east and west connection, and that they prefer to preserve their strength and funds to help such an enterprise. They have told Mr. Hubinger that they want a road built from Quincy to Beardstown, there to connect with the Baltimore & Ohio. It is said that if Mr. Hubinger can get encouragement from the Baltimore & Ohio he will undertake the project.

Indiana.—A report is current to the effect that a syndicate composed of New York and Cleveland capitalists are contemplating the building of electric lines connecting various cities and towns in northern Indiana, among which are South Bend, Valparaiso, Michigan City, LaPorte, Elkhart and several others. The syndicate which is said to be headed by Secretary of War Dan Lamont and ex-Secretary Whitney, is said to already own considerable property in Lake county where it is proposed to start the new line. The active agents of the new company are ex-Congressman Johnson and Mr. Mark W. Hanna.

Iowa.—On March 13, articles of incorporation were filed with the county recorder at Oskaloosa by Messrs. E. C. Smith, Charles E. Lofland and Fred E. Green. The purpose of the corporation is to construct a railroad a distance of four miles, connecting the Lost Creek coal mines with the Chicago & Northwestern R. at Stark station. Lost Creek is a thriving coal mine seven miles south of Oskaloosa. The capital stock of the company is $500,000.

Kansas.—A bill has passed congress authorizing the Kansas City, Fort Scott & Memphis road to build a 12 mile extension from Baxter Springs south into the Indian Territory to Miami. From the state line to Miami the proposed extension is an air line, running through a prairie country.

Mexico.—On March 17 the International Pacific R. Co., filed its charter with the secretary of state at Topeka, Kas. The company proposes to construct a line of railroad from Guaymas, Mex., to connect with the Atchison, Topeka & Santa Fe at Deming, N. M., crossing the national boundary line at Bibel. It will also operate a line of steamships from Guaymas on the North and South American coasts. The incorporators are Hugh T. Richards of Los Angeles, Cal.; Frederick Bartlett, Walter G Seaver, Charles N. Hale, and Geo. E. Woodhouse of Chicago; David D. Hoag, Fred E. Buchannan and Winfield Freeman of Kansas City, Kas. Capital stock $10,000,000.

Michigan.—The Cleveland Cliffs Iron Co., which is building the Lake Superior & Ishpeming road between Ishpeming and Marquette, is said to have recently entered into an agreement with the Chicago, Milwaukee & St. Paul, by which the latter road will be extended from Champion to Ishpeming, and freight, express and passenger trains will run over the new line direct to Marquette, making that city the Lake Superior terminus of the St. Paul system.

The much talked of extension to the Detroit & Mackinaw R. to Bay City has been definitely decided and it is said construction will begin as soon as the right of way can be secured. The company demanded terminals and right of way at Bay City free of cost, which was thought by the citizens of that city to be exorbitant, but which has finally been accepted. This extension will be about 35 miles long, and will be an extension of the line constructed last year to Omer. That extension leaves the main line of the company near Emery Junction, and extends directly south about 25 miles to its present terminus in Saginaw county. The branch was opened for freight traffic on January 15 last. Passengers are taken on freight trains.

Mississippi.—The Mobile, Jackson & Kansas City R. Co., is securing subscriptions to build a line between Mobile and Jackson, Miss. As soon as the sum of $250,000 has been secured, it is stated that English and New York capitalists stand ready to build the line also furnishing money to purchase terminals at Mobile. It is thought there will be no trouble in rising the required amount within a short time.

Missouri.—The St. Louis, Mansfield & Ava Southern R. Co., was organized at Mansfield, Mo., on March 14. This line is projected to run from Ava, Douglas county, tapping the Frisco at a convenient point in Laclede county. The preliminary survey has been run, and as soon as a charter is procured the grading will commence from Mansfield north and south. The following directors were elected: G. W. Freeman, J. C. Spence, F. E. Adams, W. D. Day, G. J. Roote, G. B. Waters, J. W. Singleton, J. A. G. Reynolds and Jno. Spurlock. G. J. Roote was made president, J. W. Singleton, vice president, F. E. Adams secretary, J. D. Reynolds treasurer and G. W. Freeman auditor.

North Carolina.—An extension to the Wilmington, Newbern & Norfolk is being strongly advocated, and active steps are now being taken to secure that end. The line already in operation is 87 miles in length, and the proposed extension is 32 miles, carrying it to Washington, as was to be when the road was projected. Should the Norfolk & Southern extend its line from Plymouth to Washington, which it is said will be done if the extension of the former road is built, it will give a continuous line from Wilmington to Norfolk, a distance of about 230 miles.

Utah.—Reports from the west state that Salt Lake and St. Louis capitalists, who have for some months had under consideration the feasibility of building a railroad from Salt Lake to Los Angeles, and a short line from Salt Lake to Sodaville, Nevada, have announced that the arrangements for both the undertakings are about completed, the necessary capital having been secured. Articles of incorporation are drawn up and filed. Both roads have been surveyed and the routes determined upon. The one to Los Angeles will be via St. George, and will cost $15,000 to $20,000 a mile. The road to Nevada will be about 250 miles in length and will connect with the Carson & Nevada line at Sodaville. It is expected that work will be commenced in the spring.

INDUSTRIAL NOTES.

Cars and Locomotives.

—It is stated that the prospective orders of the Lehigh Valley will amount to 3,000 cars, to be built this year.

—Fox trucks are to be used on the new cars of the Lackawanna, the Reading and the Lehigh Valley roads. The Fox Solid Pressed Steel Co. is turning out 140 trucks a day at its Joliet works. The company's new works at Pittsburgh are to be completed and ready for business before the end of the year.

—The 400 Rogers ballast cars which the Great Northern Railway is having built by the Wells & French Car Co. are to be equipped with the M.C.B. coupler and the New York air brake.

—The Toledo & Ohio Central is reported to be asking for bids on several hundred cars. The exact number and the class of cars is not yet determined.

—The Wheeling & Lake Erie cars were let last Saturday, 500 going to the United States Car Co. They are 60,000 lb. coal cars and will be equipped with Westinghouse air brakes. The brake beams are to be one-half National hollow and one-half Monarch. The couplers will be one-half Standard and one-half Tower, and all castings will be malleable. The springs are to be furnished by the Charles Scott Spring Co.

—The Madison Car Works has taken an order for 250 coal cars for the Wheeling & Lake Erie road.

—It is stated that the Philadelphia & Reading has ordered 500 coal cars and 25 refrigerator cars from the Union Car works of Depew, N. Y.

—The Charles Scott Spring Co. of Philadelphia will furnish the springs for the 500 Lake Shore cars being built by the Madison Car Co.

—The Central Railroad of New Jersey reports an order placed with the Baldwin Locomotive Works for one fast locomotive for service on the new express trains to be run between New York and Philadelphia. The engine is to be single expansion, size of cylinders, 19x26 in.; diameter of drivers. 85 in.; weight of engine and tender 141,000 lbs. The company has also ordered one heavy consolidation freight locomotive for service on the mountain grades. Cylinders 22x28 in. Diameter of driving wheels, 56 in., weight of engine 155,000 lbs.; tender, 85,000.

—The English steamer Wansbeck, now in port, will take 16 locomotives built by the Baldwin Locomotive Works for the Russian government. These engines are to be delivered at Libau on the Baltic. The firm has 16 more engines, which are almost completed, for the Russian government, and arrangements are now being made to charter a vessel to carry them to their destination. The Baldwins are also at work on some locomotives for China and Japan.

—Some of the cars which the Northern Pacific Railroad has recently built at its shops are designed for carrying grain and have a capacity of 70,000 lbs. These are claimed to be the largest cars ever built for this purpose. The cars are 42 ft. long on the outside, and 41 ft. inside, 9 ft. and 11 in. wide and stand 12 ft. 5½ in. from the rail to the top of the roof. They have a cubic capacity of 3,157 ft. and weigh light about 32,000 lbs.

—The Ensign Mfg. Co. of Huntington, W. Va., has just shipped 20 double hopper bottom coal cars, of 30 tons capacity, to the Alameda & San Joaquin R. Co., of California.

—The Mt. Vernon Car Mfg. Co. of Mt. Vernon, Ill., are just completing a lot of 200 coal cars for the Illinois Central R., which are equipped with Westinghouse air brakes, Chicago automatic couplers, and Monarch brake beams, and have just taken an order for 100 drop bottom gondola cars, class "G. E." for the Pennsylvania, which are 60,000 lbs. capacity, equipped with Westinghouse air brakes, Janney automatic couplers and National hollow brake beams.

—The New York Air Brake Company's complete equipment, including driver brakes and their large Duplex pump is being attached to the locomotives now being built by the Brooks Locomotive Works for the Adirondack & St. Lawrence Railroad.

—The box cars for which the Calumet & Blue Island has been taking bids as mentioned in our issue of Feb. 29, has been let to the Haskell & Barker Co.

—The Allison Mfg. Co. of Philadelphia, Pa., has contracted to build a number of eight wheel dump cars of 70,000 lbs. capacity for the Goodwin Dump Car Co. of Chicago.

—The Wisconsin Central is equipping its through passenger cars and tenders with the Gould coupler, platforms and vestibules.

—It is stated, just as we go to press, that the Madison Car Works has taken an order for the 500 box cars for the Wabash.

Bridges.

—Bids are asked until May 6 for constructing iron or steel viaducts of a total length of about 400 ft., by P.T.McGriff, ordinary of Pulaski county, Hawkinsville, Ga.

—The Pine street bridge at Lockport, N. Y., will, it is found, interfere with the working of the proposed steel lift lock which is to supersede the present locks, and the state will therefore be asked for an appropriation for a new bridge.

—The plans of the Lake Butte des Morts bridge at Menasha, Wis., which is to consist of a steel draw span 160 ft. long and about 3,000 ft. of pile approaches, have been completed. The bridge is estimated to cost $20,000.

—The railway committee of the Dominion parliament has reported the South Shore Suburban Railway Co.'s bill which gives power to construct and operate a railway and general traffic bridge over the St. Lawrence parallel to and within 200 yards of the Victoria bridge,from a point on the south shore at or near St. Lambert to a point on the north shore in Montreal, together with the necessary approaches to connect with the Grand Trunk Railway, the Canadian Pacific Railway, and the Montreal Street Railway, and with one or more lines of railway to connect the bridge with existing or future lines of railway on the south shore of the river St. Lawrence. The connecting lines to be built by the company are restricted to twenty miles in length.

—A steel viaduct across the river in Cleveland from Ontario street to Lorain street, between the Superior street add Central viaducts is proposed. The cost is estimated at about $500,000.

—A recent wreck on the Spartanburg, Union & Columbia branch of the Southern Railway badly damaged two spans of one of the bridges between Spartanburg and Columbia, S. C., so that the bridge will have to be practically rebuilt.

—The county commissioners of Lake county, Ohio, will soon let a contract for a new iron bridge across Grand river at Painesville. The total length of the bridge will be about 400 ft. All communications should be addressed to Capt. John E. Post, county commissioner, Painesville, Ohio.

—Bids are asked until April 2 for constructing an 80 ft. span steel bridge over the Ottawa river, Lima, Ohio, with roadway 40 ft. wide and two 8 ft. sidewalks, on stone abutments.

—The question of building a viaduct from the Grandin road to Tusculum, a distance of 1,000 ft., at an estimated cost of about $200,000, is being considered at Cincinnati, O. The city engineer is preparing estimates.

—St. Louis will soon possess a steel viaduct of 1,000 ft. in length, extending clear across a valley, in the middle of which flows the River des Peres, which runs alongside of the Missouri Pacific Railroad. This steel bridge will be nearly 60 ft. high, double tracked, and is built by the Manchester Road Electric Railway Company at a cost of nearly $50,000. The foundations for the structure are now being laid, and the steel is being delivered.

Buildings.

—The Berlin Iron Bridge Co. has just completed for the Citizen's Gas Co., of Bridgeport Conn., two large buildings, one 63x171 ft., comprising a purifier house, a meter house and a valve house, and the second building, 44 x 122 ft., comprising a generator house, a scrubber house and an engine room. The side walls are of brick and the roof trusses of steel covered with corrugated iron.

—Messrs. D. H. Burnham & Co., architects of Chicago have designed a new station for the Columbus Union Depot Co., at Columbus, Ohio, and will receive bids at their office for the same until April 14, 1896. In addition to the station proper, the plan contemplates the erection of a line of stores fronting on High street and adjacent to to the station. The Columbus Union Depot Co., is owned by the Cleveland, Cincinnati Chicago & St. Louis and the Pittsburgh, Cincinnati & St. Louis Railroad Co.

—The Plans for the new depot for the Texas & Pacific Railroad Co. at Fort Worth, Tex., have been prepared. The structure is to be of buff brick, one frontage of 180 ft. and one of 100 ft., four stories high, and cost about $200,000.

—It is stated that President Ingalls of the Big Four expects to arrange to issue $2,000,000 more bonds in order to secure funds to make improvements and betterments to the property, and among these will be the erection of large central shops at Indianapolis. Of the $50,000,000 of bonds which, under the reorganization plan, the Cleveland, Cincinnati, Chicago & St. Louis could issue, but $29,252,000 has yet been issued, and the plan contemplates the issuing of $1,000,000 a year if the interest of the road requires it, consequently President Ingalls, should the board consent, can issue $2,000,000 additional and not exhaust the $1,000,000 per annum which the reorganization plan would permit after the first general issue.

—The Cotton Belt Railway Co. has purchased 25 acres of land in East Gatesville, Tex., adjoining its right of way, on which to erect a stone depot and other improvements. It is understood that the line from Waco west will be laid with heavy steel rails.

—Several acres of ground are stated to have been purchased for the location of a large steel car truck manufacturing establishment on McCandless avenue, Pittsburgh. Newton A. Hamphill of McIntosh, Hamphill & Co., is interested. The buildings will be steel structure equipped with the latest improved machinery.

—The Ontario Car & Truck Company, recently incorporated at Oswego, N. Y., has purchased a site in that place, 125 x 496 ft., and will erect a large modern plant in the spring. The concern will manufacture cars, trucks, ventilators, heaters, seats and brakes. The company holds a number of patents. The capital stock is $300,000 of which $100,000 has been paid in.

—The Carterville Foundry & Machine Co., Carterville, Mo., whose shops were recently destroyed by fire, will rebuild at once. The order for its new equipment of machinery has been placed with the Davis & Egan Machine Tool Co., of Cincinnati, Ohio.

—Arrangements have been made by outside capitalists for the erection of saw mills, rice mills, car works, brick works and other industries, at Port Arthur, Tex. Plans for extensive railroad shops and roundhouses, presumably for the Kansas City, Pittsburg & Gulf Railroad, have been prepared, and it is estimated that they will, when completed, employ 300 to 400 men. F, C. Henderson, general manager of the Port Arthur Land Co., Kansas City, Mo., can be addressed for information on all these enterprises.

—The Portsmouth, Pig Point & Newport News Railroad is reported as being about to erect a hotel. Address Harry Kirn, president.

—The Plant Railway & Steamship Co. has had plans and specifications prepared for a new depot, at Ocala, Fla. The structure will be 220 ft. long and 40 ft. wide, two stories high.

—A great deal of speculative matter has been published recently with regard to the proposed new union station for the southern lines running out of Boston. The Boston Journal contains the following: "The work is to be undertaken by a terminal company in which the New York, New Haven & Hartford, the New England, the Old Colony, the Boston & Providence and the Boston & Albany Companies are to be equal stockholders. With the exception of the last named, the other roads named are either leased or controlled by the New York, New Haven & Hartford. The new union station will be at Federal and Summer streets, covering the ground now occupied by the New England station, and stretching south along the water front. In order to provide proper access to the new station, on the part of the railroads and the public, it is understood that Federal street south of Summer will be discontinued and a new street to the east of the station of ample dimensions will be constructed. It is at this point that the co-operation of the city of Boston is required, and it is understood that all the preliminary agreements as between the New York, New Haven & Hartford and subsidary roads, the Boston & Albany, and the city of Boston have been made. It is understood that the general plan provides also for the construction of a suitable station at the Back Bay, west of the crossing of the Albany and the Providence tracks, and the discontinuance of the existing stations in that territory."

Iron and Steel.

—Among the new uses of Hadfield manganese steelmade by the Taylor Iron & Steel Company of Highbridge, N. J., is that of cast, perforated curved plates for the shell of a large trommel or rotary screen which is used for sizing crushed stone for macadamizing or other purposes at the Rockland Lake plant of Cosgriff, Conklin & Foss, one of the largest producers of crushed stone on the Hudson river. There are 40 plates on each screen. The holes are ¾ in., 2 in. and 2¾ in. All the plates are ¾ in. thick. The holes are cored of course. Such castings are difficult to make of any material, but the advantages to be gained by the use of this material for this purpose fully warranted an attempt to overcome the obstacles presented in casting them of manganese steel. It is impossible to predict what the life of these plates will be in service, but it will be very great.

—The Phœnix Iron Works, of Phœnixville, Pa., has contracted to build a Ferris wheel which will be 200 ft. high and constructed entirely of steel. It will weigh about 100 tons. The foundation for the wheel will cost about $5,000.

—The Whiting Foundry Equipment Co., Chicago, recently shipped to Samuel L. Moore & Sons Co., Elizabeth, N. J., a No. 10 Whiting cupola having a capacity of 25 tons per hour, and to the Mansfield (O) Machine Works a No 3 Whiting cupola having an hourly capacity of five tons. The Globe Iron Works Company has also placed an order for a Whiting cupola which will have a capacity of 18 tons per hour. Th is cupola is seven feet in diameter.

—The property of the Chillicothe (O.) Foundry & Machine Works will be offered for sale on Wednesday, April 8. The personal property will be offered in quantities to suit purchasers.

—Oswego (N. Y.) is considering the feasibility of offering a bonus for the establishment of a plant in that city for the manufacture of steel by the so-called Coronet process, the invention of a German engineer. Lieutenant Joseph M. Mickley, who recently was ordered to make an examination of the process by Commodore Geo. W. Melville, United States navy, spent four weeks in making certain tests at the works of the Eureka Steel Co., at Chester, Pa., which included the testing of over half a million pounds of steel castings, made for government use. Lieutenant Mickley said in his report that 567,000 pounds of steel castings, weighing from five pounds to 6,000 pounds, was made and not a single castings was rejected.

Machinery and Tools.

—The South Chicago Works of the Illinois Steel Co., recently made the excellent run of 970 gross tons of rails and 30 tons of billets in 12 hours.

—John A. Roebling's Sons Co., has received the contracts to furnish the wire rope necessary for the construction of the new suspension bridges to cross the Ohio river at Rochester, Pa., and East Liverpool, O. The contract calls for about 450 tons of wire rope.

—The Anniston Iron & Steel Co., of Anniston, Ala., has purchased the best of the machinery of the old Elyton rolling mill at Birmingham, and will use it in its own rolling mill.

—Casting car wheels by machinery at the rate of one wheel every two minutes with a single machine is what the Kingston Car Wheel Co., of Kingston, Pa., is reported as doing. This company's process is a recently invented one, which it controls exclusively. Business has increased at such a pace in recent months with the company that it has decided to increase its capital stock for the purpose of enlarging the plant.

—The American Tool & Machine Co., Atlanta, Ga., has been granted a charter, with a capital stock of $100,000, to manufacture car couplers, machine tools, etc.

—John Mohr & Son, Chicago, are rebuilding their South Chicago Works, with the intention of making it one of the best equipped boiler making plants in the country. The equipment will consist of modern appliances for handling heavy work, including electric traveling cranes, very large shears and punches, hydraulic riveters, etc. The machinery will be driven by independent electric motors. Sargent & Lundy, Monadnock block, Chicago, are making the electric installation.

—The Bass Foundry & Machine Works, Fort Wayne, Ind., is reported as having recently shipped three wheels to the New Castle (Pa.) Steel & Tin Plate Co., aggregating a weight of 600,000 lbs. Each wheel was 25 ft. in diameter, 7 ft. 4⅝ in. face, 24 in. bore divided into four pieces, weighing 50,000 lbs. each

—The Westinghouse Electric & Mfg. Co., of East Pittsburgh has secured the contract for equipping a new electric line to be built by the Columbus, Hocking Valley & Toledo Railroad Co. The line will extend from McArthur Junction on the main line to Jackson, 22 miles. The equipment will consist of ten motor cars 38 ft. in length, of 75 horse power each. The rails will be 60 lbs. and a speed of 30 miles an hour will be maintained. The works of the Westinghouse Electric & Manufacturing Co., have been put on full time in every department, and the number of persons employed is larger than at any time since the new works were opened.

—The S. A. Woods Machine Co. of Boston, points with pride to the fact that since 1885 the name of S. A. Woods has stood in the front rank of woodworking machinery builders. Mr. S. A. Woods, the present head of the S. A. Woods Machine Co., was its original founder, and by his experience of 41 years has become universally known to all users of this class of tools. During its vast experience in the manufacture of labor saving appliances for the manufacture of lumber, machines have been sold for almost every known use of this kind, and for use in many lands. Of late years it has made a specialty of tools for car building purposes, and some of its very earliest machines for this purpose are in use to-day, showing the durability of its work. The variety of its line of machines is extensive, and is finely represented by the handsome catalog which it has issued and will send to any interested applicant.

—Mr. Charles Davis, president of the Davis & Egan Machine Tool Co.; Mr. Thomas P. Egan, president of the J. A. Fay & Egan Co., and Mr. Thomas McDougal, general counsel for the Laidlaw-Dun-Gordon Co., have been summoned by the ways and means committee of congress to appear before them to give information relative to the effect of the reciprocity treaties on the export trade in iron, steel and woodworking machinery. Also to confer with them as to the best methods of encouraging and enlarging the export trade in these products. This interest of congress in these matters is certainly encouraging and a forerunner of better export trade relations to follow. This fact will undoubtedly be of much interest to manufacturers throughout this country.

—Owing to its rapidly increasing business the Chicago Pneumatic Tool Co. has taken larger offices, and is now located at 1020 and 1021 Monadnock Block, instead of 1553 as heretofore.

—The Bath Iron Works at Bangor, Me., is enlarging its works. The capacity of the foundry at the northern division of the plant is to be doubled. All the wooden buildings now in use are to be removed and the new structure, which will be composed entirely of brick and steel, therefore fireproof, will be one of the most modern and completely equipped foundries in the world. The main building will be 150 ft. long and 130 ft. wide. An electric traveling crane of 20 tons capacity has been orderen of the Morgan Engineering Co., of Alliance, O. This crane has a span of 50 ft., and will be placed in the central portion of the building. It will be driven by three independent electric motors; one 16 horse power for hoisting, one of similar horse power for longitudinal travel and one of 8 horse power for cross travel of trolley on bridge. Steel jib cranes will be placed in the wings of the building for handling the lighter work. A new cupola will be put in and the foundry will have a reverberatory furnace of about 10 tons capacity for the manufacture of gum iron castings. The foundry will also be especially equipped for the manufacture of the Hyde manganese bronze for which the company has at present large orders both for government and outside work. The building will probably be completed in the course of three months.

—The rapidly growing business of the Brown Hoisting & Conveying Machine Co., Cleveland, O., will necessitate running this plant 24 hours per day during the spring months to take care of contracts on hand, one of these being for a large equipment of ore handling machinery. The crane business of the company is also developing satisfactorily.

—During the past week the Rand Drill Co. sold E. D. Smith & Co., two 20 x 36 duplex Corliss engine air compressors, and 24 slugger drills for driving the two mile tunnel, which that firm has under contract in Boston, Mass.

—Cornell University has been declared the winner of the prize lathe offered by the Davis & Egan Machine Tool Co., of Ithaca, N. Y., to the most popular technical or mechanical school in the United States, having 95,818 votes to its credit out of a total of more than 1,000,000. This lathe is the famous "silver plated tool room lathe" that attracted so much attention at the world's fair in Chicago. It is not only beautiful, but is capable of doing as much work as any tool of the kind made. Cornell is to be congratulated.

Miscellaneous.

—The Argentine government is about to spend over $6,000,000 on the completion of the harbor works at Buenos Ayres, and some $1,500,000 on the construction of dry docks.

—The Perkins tie plate tested by the Boston & Maine Railroad is said to have greatly reduced the cutting of the ties. Six ties on the main line had these plates put on it in 1889, and in 1895 the cutting of the tie averaged only ⅛ in., while on six adjacent ties without tie plates the cutting averaged ⅝ to ¾ in. These tie plates are the invention of M. R. Perkins, of Portsmouth, N. H.

—Press reports state that Julian Kendrick, and John A. Miller, engineers, have made an inspection of the proposed route of the Birmingham & Warren River Canal, which the government will be asked to build from Birmingham to lock No. 13 on the upper Warrior, a distance of 25 miles in order to secure an all-water route for the shipment of Alabama coal and iron to the Gulf of Mexico. The two engineers report the plan feasible and say that by following the Valley creek the canal can be built at a smaller cost than was at first thought.

—Rumors are abundant as to extension of the West Virginia Central & Pittsburg Railway, both east and south in early spring, but nothing official have been divulged yet. The coal and lumber trade is good and the necessity of a better eastern outlet exists.

—John B. Roach, of Chester, Pa., has received the contract to build a 3,500 ton steel passenger and freight steamship for the Maine Steamship Co., for use on the route between New York and Portland. The vessel will be about 315 ft. in length and 46 ft. beam, and will cost over $350,000. She is to be completed by January 1, 1897. The Roach shipyard is at present very full of work, three large steamships, two ferry boats and a large yacht being now in course of construction.

—The United States Wind Engine & Pump Co., of Batavia, Ill., has recently completed a 50,000 gallon tank on steel tower for the Chicago & Northwestern Railroad at Elmhurst, and a tank of similar capacity mounted on a 30 ft. steel tower for the Cleveland, Cincinnati, Chicago & St. Louis Railway.

—The Cumberland Coal Co., operating at Douglass on the West Virginia Central & Pittsburgh Railway are making preparations to add 50 coke ovens to its plant.

—The J. L. Rumbarger Lumber Co. is making preparations to increase its mill capacity by building a new one of 150,000 ft. per day. It have closed a deal by which they get 18,000 acres of fine spruce timber and with some cherry and walnut.

—After the extended trial of about a year with a completely equipped train, the Mexican National road has ordered the Mason air signal put on eighty cars and twenty-five engines. The Crane Company is now handling this appliance, Mr. Harry Mason, the inventor being connected with that company.

—Those who have csnsidered interlocking apparatus of the electro-pneumatic type as liable to interference from snow will be interested to see the following which is a copy of a dispatch sent to Mr. V. Spicer, western agent of the Union Switch & Signal Co. in regard to the working of the new Grand avenue plant in St. Louis, which was put into service last Sunday:

St. Louis, Mo., March 16, 1896.

V. Spicer:

The Union Switch & Signal Co.,
1534 Monadnock,
Chicago.

Plant went in noon Sunday; foot of snow, but working without any trouble or delays.

Stevens.

The message was signed by Mr. Thomas S. Stevens, who was in charge of the construction of the plant, and the report is good evidence of the qualifications of this apparatus to work satisfactorily under very trying conditions. A "foot of snow" would be likely to stop the operations of almost any mechanical plant, and if it would not stop a plant already in operation it would be an extremely difficult, if not impossible, to put a mechanical plant into service under that much snow.